Railway Mechanical Engineer

Vol. 98 April, 1924 No. 4

Can You Answer These Questions?

What is the division of your total expenditure for freight car repairs between cars of home and foreign ownership? How much of the total expenditure for repairs to home cars were you directly responsible for, and how much of it did you pay in settlement of M. C. B. bills? For how much of your expenditures for repairs to foreign cars were you reimbursed? Did the amount of your M. C. B. bills against other lines fully reimburse you for the work done? How much profit or loss did you take on these operations? Car for car, do you notice any difference in the amount of the bills you pay for different series of the same type? Without answers to these questions, can you intelligently determine the value of your different designs? Or can you tell whether you are collecting all that is coming to you for billable charges? Or can you determine with any degree of accuracy when and how far you should go in restoring any series of your equipment by heavy repairs, having in mind the reduction in current repair expenditures to be effected thereby? In other words, are not answers to these questions really essential as the basis for a sound policy of car maintenance and purchases?

Car Repair Competition Closes May 1

The competition on the elimination of waste at outlying car repair points closes May 1. The competition announcement on page 138 of the March *Railway Mechanical Engineer* gave a fair outline of some of the conditions that can be found at outlying car repair points. It brought out the worst conditions and had very little to say about the more efficient points. Perhaps the methods used on your road are getting excellent results. If they are, tell us how it is being done and see that the article is mailed to 30 Church street, New York, on or before the closing date. Prizes of $50 and $35 are being offered for the first and second best articles, respectively. The judges will base their decision on the value and practicability of the methods described and not on literary merit. Not winning a prize is no occasion to be discouraged for if your article contains some good ideas or suggestions, there is a possibility of its being published, in which case it will be paid for at the usual space rates. Keep in mind the closing date—May 1.

Inspection Trips to Railroad Shops

The practice among railroad men of making occasional visits of inspection to other roads is becoming quite general. For the shop man, these visits are well worth the time and the effort that they require. Naturally, the newer terminal installations attract the most attention. It is at these points the shop man expects to get the most information relative to new operating methods and shop layouts. It is a mistake, however, not to visit the older shops and terminals. No matter how interesting the newer terminals may be, representing, as they usually do, the latest developments in scheduling systems, methods of material handling, machine tools, drop pits and fuel handling equipment, it is just as profitable to visit the older shops to see how the difficulties of utilizing old equipment and antiquated shop layouts are being overcome. One is reminded of the old saying that fine birds do not always wear fine feathers. It is a notable fact that the most ingenious ideas for shop kinks have originated in the older shops and it has been a rare occasion where a trip through an old railroad shop has not revealed something unusual in operating methods, special facilities, arrangement of machine tools or in erecting work.

Training for Leadership

So far as the rank-and-file are concerned, the foreman or subordinate supervisory officer with whom they come directly in contact represents the management, and they judge the management by these men. The foreman must be in a position to interpret the policies and aims of the management to the men and at the same time must bring the needs of the men to the management, or rather, interpret the men to the management. To do this successfully, and at the same time secure the greatest possible efficiency from the organization, the foreman must be a real leader and constructive force.

Men are ordinarily promoted to the position of foremen because they have proved to be master workmen and have personalities which command respect and indicate leadership ability. Unfortunately no definite training is given these men in the art of leadership. It is rather assumed that a man's experience in the ranks and his ability as a master craftsman have fitted him for leading men. This seems rather strange when we stop to think that men are required to study intensively for long periods to perfect themselves for comparatively simple vocations. A professional man must spend years in such training, and yet it is doubtful if any profession is much more difficult and intricate than that of successfully leading men.

It is, of course, true that our industrial and transportation agencies have grown in size so rapidly that the importance of leadership has not been thoroughly recognized, or has been lost sight of because of this rapid growth. The lack of proper leadership, however, has brought about exceedingly serious complications in our organizations—questions so grave and so great that they are pressing hard for a solution. Fortunately there has been a growing conception in recent years of this need, and while it is not yet generally fully recognized, various steps are being taken to improve conditions. We would direct attention, for instance, to the formation of foremen's clubs, designed particularly to promote the study and discussion of the fundamental principles of leadership and their application to specific problems. There are several varieties of such clubs, from those which are highly organized, with ambitious programs, to those which meet at intervals in a more or less informal way.

Then, too, there is the tendency for the ranking local officer to hold more frequent and more comprehensive staff meetings. There has also been a noticeable tendency in recent years for a larger degree of study by the foremen of special courses adapted to their needs and for a wider reading of current periodicals.

This is a good beginning, but the matter of successful leadership is so complicated, and it is becoming so much better understood, that it would seem that department heads and managements should take a larger degree of interest in helping their foremen and subordinate officers to get a larger knowledge and training in this respect than is ordinarily possible. It must be recognized that real leadership not only demands certain specific qualifications on the part of the individual, but that much study and training are required to perfect it, as is true in the case of any other profession. Leadership is not a vocation—it is an art. It is becoming more and more generally recognized that the foremen and subordinate officers hold the key to the solution of the labor problem. Why not then face up to the situation and assist these men in every way possible to perfect themselves in leadership, and to back them up in such a way as to make their personalities and efforts count for the very most?

How to Avoid Government Ownership

In addressing the American Railway Engineering Association at its recent meeting in Chicago, Sir Henry Thornton, chairman and president of the Canadian National Railways, spoke of the relations of the railways to the state. In concluding he made this statement: "The fate of our great railway undertakings will depend to a very large degree upon the sagacity, the justice and statesmanship of those who administer these properties during the present uncertain period, when the psychology of man is undergoing a rapid change and development throughout the civilized world." The continued prosperity of a nation is so intimately interwoven and dependent upon the extent and strength of its transportation systems, that in the light of Sir Henry Thornton's statement, a tremendous responsibility rests upon the shoulders of those who are in charge of their direction. Sir Henry also indicated that, "State ownership is only practicable * * * in the event of complete divorcement from influences other than those which have for their object the welfare of the community."

The evils of government ownership of railways, as they have been experienced in most countries, are such that this country and those in charge of the railroads will do well to maintain conditions which will make it possible to promote and continue private ownership. What are the cardinal principles essential to the existence of a railway as a private enterprise? Sir Henry indicated that there were three such principles: (1) It must maintain solvency and meet its financial obligations; (2) it must furnish adequate transportation at reasonable rates to the public; (3) it must pay to its employees that wage which under reasonable conditions will permit them to live in decency and comfort, under sanitary conditions, and to educate and bring up their children as self-respecting members of society.

If any one of these essentials is disregarded for an extended length of time it may bring about government ownership, while if more than one of them is disregarded, government ownership is likely to come about quickly. In another part of his address, Sir Henry indicated that there was still a fourth factor, which is social in character. That is the increasing spirit of discontent and dissatisfaction in the masses of the public in all countries with respect to the distribution of wealth, which must not be ignored by those who wish to retain in private hands those forms of industry which vitally affect the welfare of the community.

Sir Henry Thornton, because of his wide experience in railroading in this country, Great Britain and Canada, is well qualified to discuss this question of private and government ownership. The railroad labor unions in general have been leaning toward government ownership in this country, although it is extremely doubtful whether any considerable number of the members are following their leaders in this respect; as a matter of fact, some of the labor leaders have come out openly and very strongly against government ownership. If this country, however, is to continue the advantages of private initiative and ownership, the essentials laid down by Sir Henry Thornton should be given the most careful consideration and every effort should be made to educate railroad employees and the public at large to the real facts about the railroads and the advantages of private ownership.

What Do You Get From Your New Power?

The tests made last December by the Lehigh Valley on its three-cylinder Mountain type locomotive for fast freight service are noteworthy not alone because of the novelty of the design of the locomotive and the attractive results shown, but as well because of the infrequency with which the railroads generally subject the merits of their new power to any such examination. Even on the most conservative of railroads some progress or at least some change, is shown in motive power development with successive orders of new locomotives. Some of these modifications are purely mechanical for the purpose of facilitating or decreasing the cost of maintenance. Other important changes, however, are made with the purpose of improving the performance in some respect. With the present almost complete inability of the average department head to arrive at any measure of performance of one class of power as compared with another by statistical analysis, the only possible way of ever determining whether or not the new class of power is adequately fulfilling the expectations of its designer is by means of road tests, simple or elaborate as circumstances will permit or as the nature of the comparison made requires. Without such tests, the only evidence of the value of the latest order of locomotives to be placed in service is such effect as these locomotives may have on the general average of performance results, which may be negligible because of the relatively small number of locomotives in question, or may be completely offset by adverse conditions developing elsewhere in the service. In the formulation of sound policies of locomotive acquirements, the exercise of the highest degree of intelligence is required. Intelligence, however, implies knowledge, without which it is of little value. Whatever it may cost, the price of adequate knowledge is an investment on which a big return is sure to be obtained through the elimination of costly mistakes and the speed with which full advantage may be taken of profitable developments.

Possibilities in X-Ray Inspection

To the uninitiated, the X-ray is a sort of mysterious thing far beyond the scope of ordinary man. Based on a seemingly complicated theory, its development and application to industry has been largely relegated to the scientist and his laboratory. It is a difficult matter for a practical shop man to understand how a study of atoms, electrons and various other minute invisibilities is going to be of any particular benefit to his business. It will be of interest, however, to know that by the use of the X-ray, metallurgists have been constantly improving the quality of forgings and castings. X-ray studies and examinations of the crystalline structure have already brought about a considerable improvement in the properties of old alloys and have greatly assisted in developing new alloys or heat treatments to satisfy new requirements.

In a recent address before the New York Chapter of the

American Society for Steel Treating, Dr. Ancel St. John brought out the fact that improvements in the quality of materials permit a lower factor of safety. This was illustrated by citing some results of investigation work by the Ordnance Department at Watertown Arsenal. Reduction of weight is an important factor in ordnance design and for this reason a low factor of safety is used wherever possible. Of course, this means that the materials used must be of exceptionally high quality, free from fissures or blow holes that sometimes develop in the process of manufacture. In order to obtain a thorough inspection of all forgings or castings, a portable X-ray machine has been built that has a penetrating capacity to approximately six inches. This method of inspection has enabled the designer of ordnance equipment to reduce the factor of safety in many cases as low as 1 and 1.5.

The nature of the application of such a low factor of safety in other industries, outside of ordnance work, is a matter of conjecture at the present time. However, there is a possibility of X-ray inspection becoming an important factor in locomotive construction.

At present, locomotives are designed with a sufficiently high factor of safety to allow for any probable defects in material or workmanship. This factor varies anywhere from 3 to 5 according to the nature of the load. Naturally, a high factor of safety means increased weight. There is also to be considered the fact that parts having a large cross-sectional area occupy space that is gradually becoming more valuable as the size of locomotives increase and clearance limits remain stationary.

X-ray, or radiographic, examination should also prove valuable for boiler inspection, especially in the manufacture and purchase of new material. A single radiograph can give more information as to the extent and character of fissures and inclusions than any number of sample sections, and does so without damaging the specimen.

The work of development has not yet progressed far enough to bring the cost of radiographic examinations within practical limits for general industrial application. The penetrating power of the X-ray has only been known to science for approximately six years, and judging by its development during that time, it should not be long until it can be profitably used by industries not directly engaged in the manufacture of iron and steel. In the case of the railroads, where the question of increased capacity and human safety are always of prime importance, the utilization of the X-ray may well be given early consideration.

New Books

TRADE STANDARDS. *Brochure resulting from a research by executives and engineers associated with the Compressed Air Society. Thirty-nine pages, 6 in. by 9 in. five illustrations, paper bound. Published by the Compressed Air Society, 50 Church street, New York.*

The Compressed Air Society has published this brochure with the belief that there is a need for such an authoritative work of reference and that compressed air engineers, and users as well as manufacturers of air compressors, will appreciate such a step toward the establishment of definite trade standards in the industry. The work embodies the result of extended study and research on the part of the executives and engineers associated with the members of the Compressed Air Society. It embraces the nomenclature and terminology relating to air compressors and their operations; a history of the development of speeds of air compressors; an explanation of capacities and pressures; instructions for the installation and care of air compressors with illustrations of devices suggested for cleaning the intake air; recommendations for the lubrication of air compressing machines and the cleaning of air receiver piping, and a description of the low pressure nozzle test recommended by the society.

The compressed air industry has been in need of this sort of reference book for a number of years. It should be the forerunner of a more elaborate and complete book covering the various detailed phases of the industry. This brochure also contains a partial list of the application of compressed air which can readily be expanded by illustrations and descriptions. Its worth can be increased by annual revisions and additions of information commensurate with the growth of the industry.

MANUAL OF INSTRUCTION FOR WELDING OPERATORS. *Published by The Welding Engineer, Chicago, Ill. 17 pages, 6 in. by 9 in.*

This pamphlet has been prepared primarily for the convenience of welding schools and welding departments where the Welding Encyclopedia is used as a text. A review of the encyclopedia was published in the November, 1923, number of the *Railway Mechanical Engineer*. The manual contains a complete set of outlines of lessons, exercises and examinations for the training of oxy-acetylene welders and electric arc welders. All of the material contained therein has been reproduced directly from the encyclopedia, which for purposes of instruction, provides a more convenient form for handling.

A CENTURY OF LOCOMOTIVE BUILDING BY ROBERT STEPHENSON & COMPANY, 1823-1923. *By J. G. H. Warren. Published by Andrew Reid & Co., Ltd., Akenside Hill, New-Castle-upon-Tyne, England. 461 pages with over 300 illustrations from original portraits, documents, drawings, engravings, letters, etc., and several plates; size 8 in. by 11 in. Bound in Cloth. Price 28 shillings.*

Invariably the history of a great industry is the biography of great men. For this reason it is not strange that an account of a hundred years' growth and achievement in locomotive building by Robert Stephenson & Company should be principally an account of the life of George Stephenson and his son, Robert. Twenty-two of the thirty chapters are concerned with the development of the locomotive during the classical period, which may be said to have terminated at the death of Robert Stephenson.

The author has told the story in a commendable manner. Based on original documents still in the possession of the descendants of the two original partners, Edward Pease and George Stephenson, and illustrated with numerous reproductions in fac-simile of original manuscripts, he has produced a book that is intensely interesting. These have been supplemented by contemporary documents and drawings from English, French, German, Russian and American sources. Some of the most important are published in this book for the first time.

The greater part of the book deals with the evolution of the locomotive in its early stages. It brings out in a striking manner the influence that the roadway and track had on the mechanical development. The fact that the elder Stephenson made a remarkable record as a civil engineer and devoted a large part of his time to such work as the construction of the Liverpool and Manchester and various other lines, was given careful consideration by the author in showing the effect this training had on the early growth of the locomotive. It was George Stephenson who advocated the wrought iron rail in preference to cast iron in order to carry a heavier locomotive. The development of the "Rocket" and its success at the Rainhill trials is told in an interesting and instructive manner. That the work of the Stephensons was not without its trials and tribulations is well brought out in the account of the various controversies as to the relative merits of the different methods of locomotion advocated at that time.

The victory of the "Rocket" at these trials was a fortunate

event, for it permitted further experimentation along the lines established by the winning locomotive. As it so happened, Robert Stephenson & Company was enabled to go ahead with considerable experimental work in which it tried out both the four and six-wheel types and also conducted performance tests to determine drawbar pull and cost of operation.

It is interesting to read of the period of separation of the American from the English design. A number of locomotives were shipped by Robert Stephenson & Company to America, the types following closely those that were being developed in England at that time. It was the result of a careful study of one of the first engines of the "Planet" type sent to America that Matthias W. Baldwin built the locomotive known as "Old Ironsides." The unfavorable conditions under which locomotives were required to operate in this country soon led to the development of the engine truck and cow catcher. Cast iron wheels were substituted for the wooden ones and cast iron crank axles were found to give excellent service. Regulator and steam pipes were fitted outside the boiler and a bell was also added to the equipment.

The book contains a wealth of information not only to the general reader and student of railway history, but also to the designer of locomotives.

What Our Readers Think

Who Can Answer This Question?

DENVER, Colo.

TO THE EDITOR:

We are having considerable trouble with loose crown brasses. Our boxes are slotted out to a radius from shoulder to shoulder, then the crown brass is turned on a special mandrel to the required radius, after which it is laid off with special calipers touching in the back and both shoulders, with about ¼ in. tip to give from 8 to 18 tons pressure. We then take the boxes to the babbitt shop where they are heated to apply the lateral side plates. But whether there is not enough tonnage on the crown brass or whether they get too hot at the babbitt fire, we have not been able to determine. If some of the readers of the *Railway Mechanical Engineer* can give the cause of the troubles I will be very thankful.

MATTHEW DEVLIN.

[The following letter was received in response to a request for an answer to this question. We shall welcome other answers from our readers.—EDITOR.]

A Discussion of Loose Crown Brasses

GREENVILLE, Pa.

TO THE EDITOR:

The cause of loose crown brass trouble may be partially determined by assuming the existence of certain conditions not definitely described in Mr. Devlin's letter.

If we first assume that the driving boxes receiving the brasses at 8 tons pressure, are of cast iron and suitable for journals of about seven inches in diameter and those receiving brasses at 18 tons pressure are made of cast steel and designed for journals of eight inches or nine inches in diameter, we may conclude that the pressures used do not vary greatly from the practice of many other shops.

A second condition that is not mentioned in the letter is the degree of looseness existing in the fit between the box and the brass. Usually brasses show indications of looseness by grease working out from between the brass and the box. Sometimes after a brass is removed from the journal, it will sound sufficiently loose when tapped on the inner surface with a hammer, to justify removal. However, in order to answer the question completely, one should know if these conditions applied, or whether the brasses were permitted to become loose enough to allow their removal from the box with little or no force before it was considered necessary to renew them.

The term "loose driving box brass" covers a wide range of conditions, as cited in the preceding paragraph. While we do not know the exact limitations required by the Interstate Commerce Commission, we do know that the intent of Rule 137, relative to the inspection and testing of locomotives, is clearly expressed in the first sentence; namely, "Driving boxes shall be maintained in a safe and suitable condition for service. Broken and loose bearings shall be renewed. Not more than one shim may be used between the box and bearing."

Although grease may work out around a brass at its bearing within the driving box, there is no reason to consider that it is unsafe so long as the brass is properly secured in the box by plugs, flange or other means for retaining it in place. Again, as long as the condition of the fit does not in any way tend to impair the proper operation of the driving box, it can hardly be said that the brass is not in a suitable condition for service. This is evidenced by the fact that driving boxes with slip fit brasses—that is, brasses that may be removed without taking the box from its pedestals—have been in use for some time. The slip fit crown brasses used in boxes of this type do not give any more trouble from loosening than do the pressed in crown brasses used in another design of driving box. In this comparison the locomotives are supposed to be the same, operating under identical conditions.

If the boxes in question are of the type just described, the pressure stated should be sufficient. The cause of the looseness is undoubtedly other than lack of sufficient fit allowance in applying the brass, provided the machining of both pieces has been properly performed.

It will be found that all boxes are not carefully machined in the circular recess owing to a change of tools being made at a point from one to two inches from the shoulder. This frequently leaves a high place on the machine surface that indicates a false fit because of the force necessary to press the brass into the improperly machined recess.

Mr. Devlin does not state to what temperature the box is heated preparatory to pouring the hub plate. If the box was heated sufficiently to discolor the metal to a blue or blue-green shade, the temperature of the box and brass would be about 600 deg. F. The expansion of brass is very nearly one and one-half times that of cast iron or cast steel. If the brass is 10 in. in diameter, then the circumferential distance from shoulder to shoulder of the box will be about 19 in. The difference of expansion in the two metals at 600 deg. F. will make the brass measure on the circumference 1/32 in. larger than the recess of the box measured in a like manner. One of two things must happen in this case; either the box must spring or open sufficiently to allow for the expansion of the brass, or the brass must compress and accommodate itself to the resistance of the box with consequent looseness when both become cold.

Driving box brasses that are forced in at excessive pressures will sometimes spread the boxes ⅛ in. or ¼ in. at the bottom. If a brass applied in this manner becomes excessively heated in service and requires renewal, the cellar is usually found to be very tight in the box. When the cellar is removed, the box will be found small at the bottom, which indicates that the strain imposed in applying the brass was sufficient to compress the brass when heated.

If the brasses mentioned by Mr. Devlin are found to be loose after applying the hub plate and before being put into service, the condition may be due to preheating the box. This may be eliminated by discontinuing the practice of preheating, which is not necessary. Either brass or babbitt may be poured without preheating the box. F. M. A'HEARN.

L. V. Tests of Three-Cylinder Locomotive

Fast Movement of Heavy Trains Produced with Low Fuel Consumption and High Boiler Efficiency

ON December 29 and 30, 1923, road tests were run on Lehigh Valley Locomotive No. 5000, a three-cylinder Mountain type for freight service, built by the American Locomotive Company, to measure the fuel and water performance and the horsepower developed. The first 45 miles of the run on December 29 were steadily ascending with maximum grades slightly greater than 21 ft. per mile and an overall difference of elevation of 340 ft., followed by a 20.5-ft. descent for about 10 miles. The run in the opposite direction on December 30, started with 29 miles of slightly rolling grade followed by 14 miles of continuous ascent at the rate of 20.5 ft. per mile and 34 miles of rolling descent for the latter part of which continuous grades of 21.1 ft. prevail. With trains averaging 4,274 tons, the coal consumption averaged 62.7 lb. per 1,000 gross ton miles. The indicator results showed a water consumption per indicated horsepower-hour, including the auxiliaries, of 20.36 lb., a coal consumption per indicated horsepower-hour, including auxiliaries, of 2.72 lb., and a maximum indicated horsepower exceeded 3,000. For the two runs, the overall efficiency of the boiler averaged 77.58 per cent.

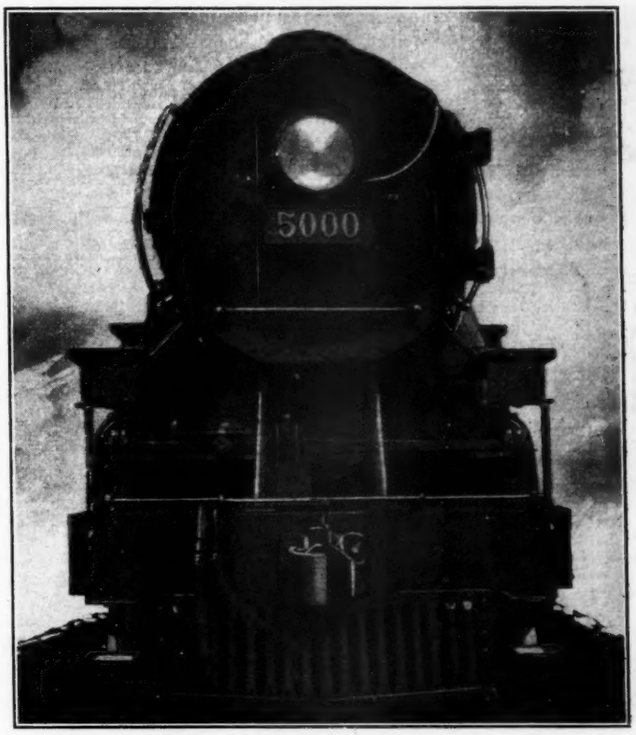
The locomotive was placed in operation on the Lehigh Valley in October, 1923. It was designed following the experience of the builders with a converted two-cylinder 4-8-2 type fast freight locomotive, which was placed in service with three cylinders on the New York Central in 1922.*

The Lehigh Valley locomotive is a complete new design. It has, however, the same size cylinders and driving wheels as the converted New York Central locomotive. The boiler, on the other hand, is built with a combustion chamber and fitted with a Type A, instead of the Type E, superheater, and unlike the New York Central locomotive, the main rod of the inside cylinder is connected to the second pair of driving wheels, while the outside main rods are coupled to the third pair of wheels. The principal dimensions and proportions of the Lehigh Valley locomotive are given in one of the tables.

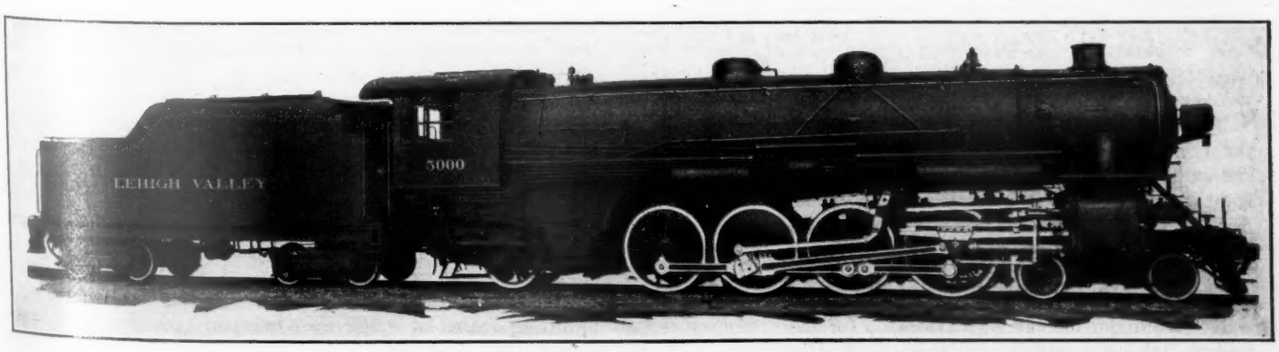
The Road Tests

Prior to the tests, the locomotive was taken into the East Buffalo shops of the Lehigh Valley and equipped with the necessary apparatus for measuring the fuel and water and indicating the cylinders. The tank was fitted with gage glasses at the corners for measuring the water, and was calibrated by weighing out the water in a barrel mounted on a platform scale. A drop bottom coal box was placed in the tender for measuring the coal, the capacity of the box having been checked by dumping and weighing the contents a number of times. Steam temperatures were taken by thermometers placed in the left steam pipe close to the steam chest and in the exhaust passage, and pressure gages were applied to both the saturated and the superheated sides of the superheater header. The boiler pressure was shown on a recording steam gage placed so that it could be read from the indicator box. A speed recorder was placed in the cab and a revolution counter used for checking purposes. Indicators applied to the three cylinders completed the equipment.

The locomotive was fired with mine run bituminous coal,



Front End of the Three-Cylinder Locomotive, Showing the Inside Valve Motion



Lehigh Valley Three-Cylinder Simple Mountain Type Locomotive for Freight Service

* This locomotive originally had 28-in. by 28-in. cylinders. The conversion consisted of applying three 25-in. by 28-in. cylinders, a Type E superheater, an Elesco feedwater heater and an Elvin stoker. For a description of this locomotive see the *Railway Mechanical Engineer* for November, 1923, page 743.

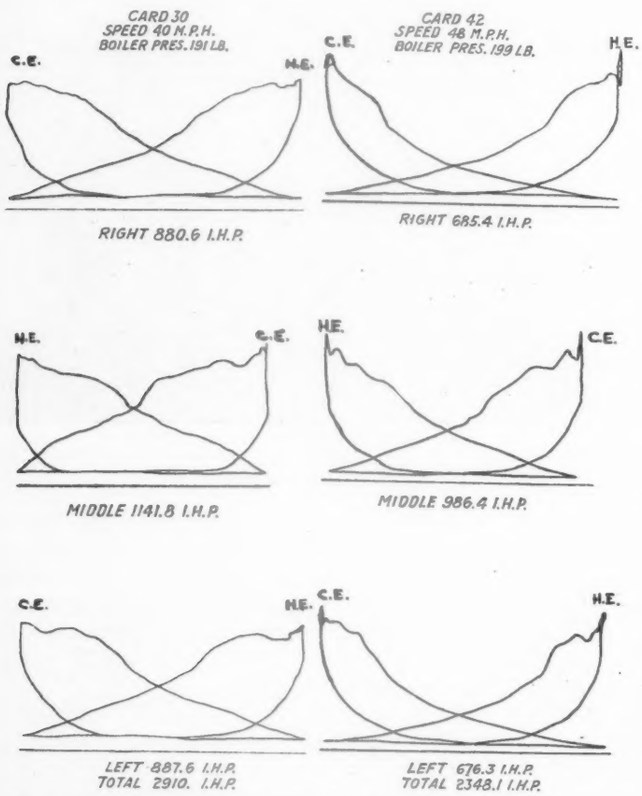
with average heat value of 12,656 B. t. u. as fired, with the following proximate analysis:

Moisture	2.76 per cent
Fixed carbon	51.73 per cent
Volatile	33.59 per cent
Ash	11.99 per cent
Sulphur, separately determined	2.46 per cent

The weather was clear and the temperature averaged 37.5 deg. F.

A summary of the test data and the results of the two runs made on December 29 and 30 are shown in one of the tables. The first of these runs was made from Tifft Farm to Caledonia, where the necessity of setting out a car for a hot box terminated the tests. This is a distance of 59.4 miles, of which 56.4 miles required the working of the locomotive, and the remaining three miles were drifted. On December 30 a run was made from Manchester to Depew, a trip on which the train drifted for 13 miles from mile post 425 to Depew. In the test results, no deductions have been made from the fuel and water consumption for this drifting period so that the entire fuel and water consumption is charged against the actual working time of the locomotive.

The average cut-off at which the locomotive worked on this run was 53 per cent and the fuel consumption was 2.56 lb. per indicated horsepower-hour, in which is included the coal required to operate the stoker and air pumps, which used saturated steam, as well as that lost at the pops. In the table, an estimate is given of the coal consumption per indicated horsepower-hour, deducting the amount required for the operation of the auxiliaries. In estimating this deduction care was taken to avoid overstating and rather to understate the amount of the deduction.



This Card Was Taken on December 29; Speed 40 M.P.H.

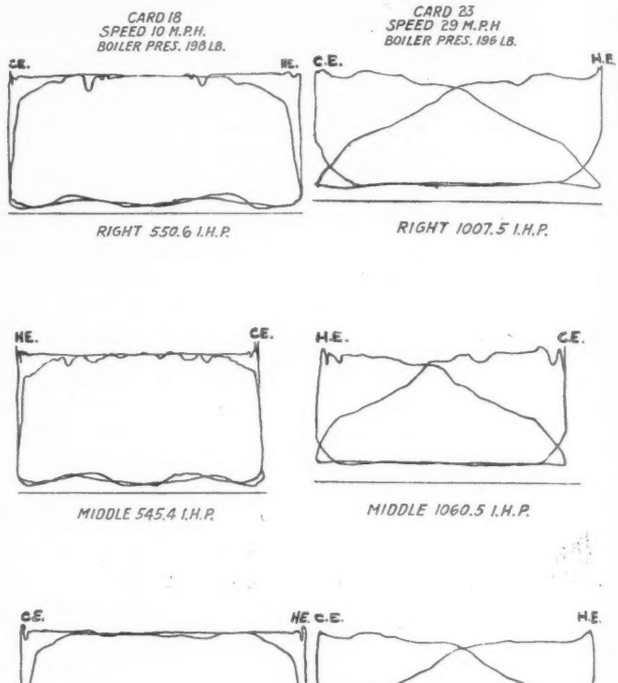
This Card Was Taken on December 30; Speed 48 M.P.H.

General Performance of the Locomotive

No dynamometer car was available for the foregoing tests, and though no record is available of the drawbar pull of the locomotive and its exact performance while starting, it was generally observed that the train started smoothly and quickly, with a noticeable absence of jerks. Its riding qualities are said to be exceptionally smooth and free from lurching and vibration at high speeds.

The freight power on the Buffalo division, where the test runs were made, with which the performance of the three-cylinder Mountain type locomotive may be compared, is largely of the Mikado type, with a few locomotives of the 2-10-2 type. The lighter Mikados used on this division have a starting tractive force of 59,000 lb. for the locomotive alone and 69,000 lb. for the locomotive and the booster. The tonnage rating of these locomotives over this division is 3,000 and 3,500 tons, respectively, for the two conditions named. These locomotives have two cylinders, 27 in. by 30 in., 63-in. driving wheels, and carry 200 lb. boiler pressure. The weight in working order is 237,900 lb. on the drivers and 325,200 lb. total for the engine. The heavier Mikado locomotives have a tractive force of 63,000 lb. for the engine alone and 73,000 lb. for the engine and booster. These locomotives have a tonnage rating of 3,250 and 3,750 tons, respectively. They have cylinders 27 in. by 32 in., 63-in. driving wheels and also carry 200 lb. boiler pressure. The weight on drivers is 235,500 lb., and the total weight of the engine is 318,000 lb. The Santa Fe type locomotives have a tractive force of 72,600 lb. without booster and a rating of 3,500 tons. These engines have 29-in. by 32-in. cylinders, 63-in. driving wheels and carry 200 lb. boiler pressure. The weight on drivers is 289,000 lb. and the total weight of the engine, 370,000 lb.

The three-cylinder Mountain type locomotive, with a tractive force of 64,700 lb., has proved itself capable of handling trains of 4,500 tons over this division and has received that tonnage rating. It has moved trains of 4,000 tons over the division, a distance of 94 miles, in 4 hrs.



Low Speed, Long Stroke Indicator Card Taken on December 29

Indicator Card, Showing Maximum Horsepower, Taken on December 29

30 min., as compared with running time of 5 hrs. 40 min. for the heavier of the two Mikado type locomotives handling a train of 3,000 tons, and 6 hrs. for the Santa Fe type locomotive with a train of 3,500 tons.

Performance on Grades

Following the tests on the Buffalo division, engine No. 5000 was transferred to a 145-mile run between Sayre, Pa., and Lehighton, to determine whether the locomotive could operate milk trains over the mountain, weighing approximately 1,200 tons, which were regularly handled by Pacific type locomotives, double-headed.

Eastbound, the first 85 miles from Sayre is practically level, with a total decrease in elevation of slightly over 200 ft. to Pittston Junction, just east of Coxton. From this point, the grade is steadily ascending to Glen Summit Springs, a distance of 24 miles, of which 13 miles has a ruling grade of 61.5 ft. per mile. From Glen Summit Springs the grade descends to Lehighton with a total difference in elevation of 1,270 ft. From Lehighton west, the first 36 miles is ascending. The last 9 miles of the ascent is at the rate of 63 or more feet per mile, with a comparatively short ruling grade of 69 ft. per mile. From Glen Summit Springs to Pittston Junction, the total decrease in elevation is approximately 1,175 ft.

Eastbound, over the 61.5 per cent ruling grade, the practice has been to operate the milk trains with two Pacific type locomotives, one with a tractive force of 48,720 lb. and the other, with a tractive force of 41,530 lb., giving a total of 90,250 lb. The larger locomotive has cylinders 27 in. by 28 in., 73-in. driving wheels, and carries a boiler pressure of 205 lb. The total weight on the drivers of these locomotives is 204,560 lb. The lighter of the two locomotives has 25-in. by 28-in. cylinders, 77-in. drivers and carries a boiler pressure of 215 lb. In this case, the weight on drivers is 161,940 lb. The combined tonnage rating of the two locomotives is 1,300 tons, and the average train consists of 19 loads and one caboose.

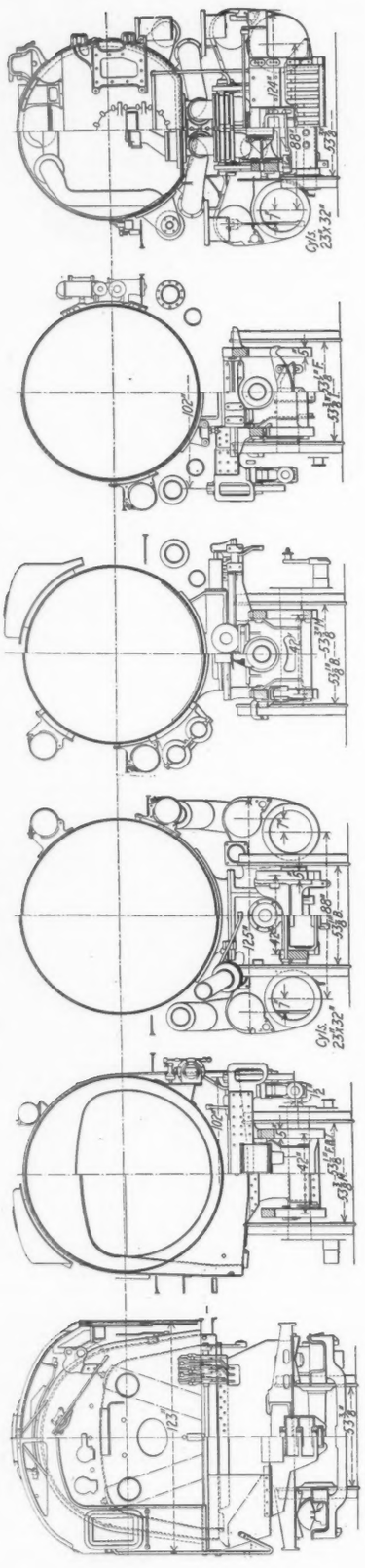
On the westbound trip, the train load averages 38 empty cars and two cabooses, and is handled by two Pacific type locomotives of the larger class briefly described above. This gives a total tractive force of 97,440 lb. Locomotive No. 5000 was given a trial trip with a milk train weighing a little over 1,300 tons, which it handled over the mountain without helper service, making schedule time. Since the trial trip, the locomotive has been regularly assigned to this service and, in some cases, has handled trains as heavy as 1,550 tons. On the westbound trip over the heavier grades of 63 to 65 ft. per mile, the locomotive has lost a little time on the schedule as compared with that made by the two Pacific type locomotives. The schedule over the division, however, has usually been maintained without difficulty, and time has been made up on several occasions. Speeds of over 60 miles an hour are frequently required on level track.

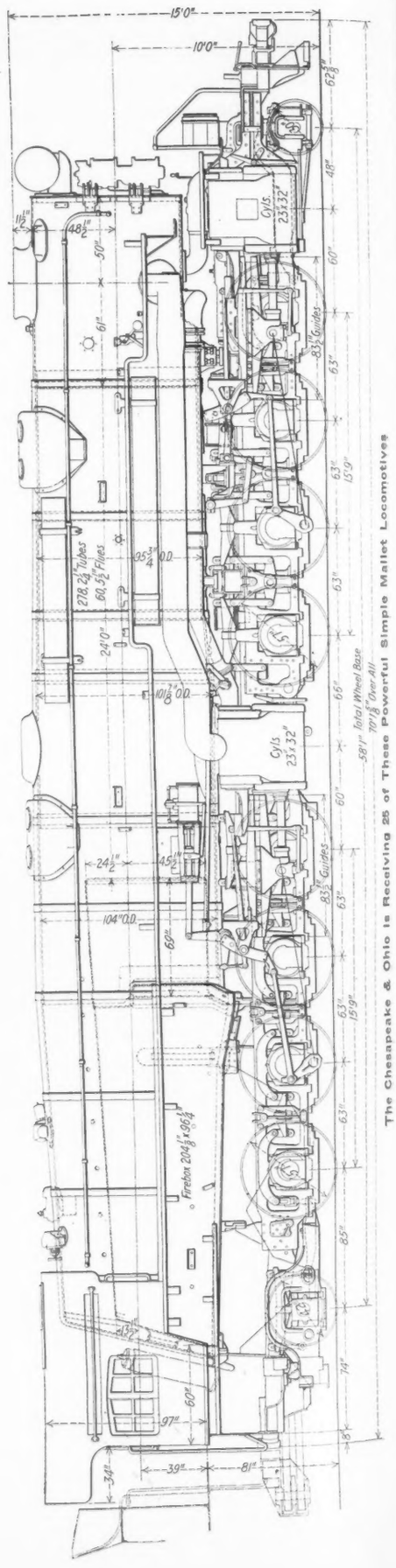
TABLE OF DIMENSIONS, WEIGHTS AND PROPORTIONS OF LEHIGH VALLEY LOCOMOTIVE NO. 5000

Builder	American Loco. Co.
Type of locomotive	4-8-2
Service	Freight
Cylinders, number, diameter and stroke	3—25 in. by 28 in.
Valve gear, type	Walschaert
Weights in working order:	
On drivers	246,500 lb.
On front truck	66,000 lb.
On trailing truck	56,500 lb.
Total engine	369,000 lb.
Tender	201,000 lb.
Wheel bases:	
Driving	18 ft.
Rigid	18 ft.
Total engine	41 ft. 2 in.
Total engine and tender	77 ft. 8 in.
Driving wheels, diameter outside tires	69 in.
Boiler:	
Type	Conical
Steam pressure	200 lb.
Fuel	Bitu. coal
Diameter, first ring, inside	82½ in.
Firebox, length and width	126⅛ in. by 96¼ in.
Combustion chamber length	52 in.
Tubes, number and diameter	230—2¼ in.
Flues, number and diameter	50—5½ in.
Length over tube sheets	21 ft.
Internal area through tubes and flues	10 sq. ft.
Grate area	84.3 sq. ft.
Heating surfaces:	
Firebox, comb. chamber and arch tubes	392 sq. ft.
Tubes	2,832 sq. ft.
Flues	1,505 sq. ft.
Total evaporative	4729 sq. ft.
Superheating	1,249 sq. ft.
Comb. evaporative and superheating	5,978 sq. ft.
Special equipment:	
Brick arch	Security
Superheater	Type A
Stoker	Elvin
General data estimated:	
Rated tractive force, 85 per cent	64,700 lb.
Cylinder horsepower (Cole)	3,378
Speed at 1,000 ft. piston speed	44.0 m.p.h.
Weight proportions:	
Weight on drivers ÷ total weight engine, per cent	66.9
Weight on drivers ÷ tractive force	3.81
Total weight engine ÷ cylinder hp	109.2 lb.
Boiler proportions:	
Comb. heat surface ÷ cylinder hp	1.74
Tractive force ÷ comb. heat. surface	10.83
Tractive force × dia. drivers ÷ comb. heat. surface	.749
Cylinder hp. ÷ grate area	40.1
Firebox heat. surface ÷ grate area	4.65
Firebox heat. surface, per cent of evap. heat surface	8.29
Superheat. surface, per cent of evap. heat. surface	26.42

SUMMARY OF THE ROAD TESTS OF LEHIGH VALLEY LOCOMOTIVE NO. 5000

Date of test	Dec. 29	Dec. 30	Average
From	Tifft Farm	Manchester	
To	Caledonia	Depew	
Length of run, miles	59.4	77.4	68.4
Working distance, miles	56.4	62.4	59.4
Drifting distance, miles	3.0	15.0	9.0
Time, actual, start to stop	198	246	222
Time, delays, minutes	9	24	16
Time, running, minutes	189	222	207
Time, drifting, minutes	17	32	24
Number of stops	1	2	1.5
Number of cars in train, including caboose	94	64	79
Gross weight of train, excl. of locomotives	4,619 tons	3,929 tons	4,274 tons
100 ton-miles, based on distance run	2,744	3,041	2,892
Average speed while working, m.p.h.	19.68	19.70	19.69
Average speed while in motion, m.p.h.	18.87	20.92	19.89
Average temp. of feedwater in tank	40.2 ° F.	40.0 ° F.	40.1 ° F.
Average temp. of steam in branch pipe	615.5 ° F.	623.0 ° F.	619.3 ° F.
Average temp. of steam in exhaust.	334.7 ° F.	310.7 ° F.	322.7 ° F.
Average pressure in boiler, lb.	185.6	194.1	189.9
Average pressure in saturated side of header, lb.	183.3	184.6	184.0
Average pressure in superheater side of header, lb.	175.6	180.6	178.1
Water from tank, lb.	131,840	138,550	135,195
Water lost at inj. overflow (est.) lb.	20	20	20
Water to auxiliaries, lb.	3,720	4,433	4,076
Water lost through pops, lb.	564	1,380	972
Water to cylinders, lb.	127,536	132,717	130,126
Water apparently evaporated per pound of coal as fired, lb.	7,288	7,658	7,473
Water app. evap. per hour, working time, lb.	45,984	43,746	44,865
Water to superheater per hour, per cent of total	96.75	95.80	96.28
Water per i.hp. per hour, incl. auxil., lb.	21.09	19.63	20.36
Water per i.hp. per hour, less auxil., lb.	20.40	18.80	19.60
Water per 100 ton-miles, lb.	48.04	45.55	46.80
Factor of evaporation, boiler only	1.226	1.227	1.226
Factor of evaporation, boiler and superheater	1.357	1.361	1.359
Factor of evaporation combined (B.t.u.'s in steam total divided by 970.4 × total water evaporated)	1.353	1.355	1.354
Coal as fired per hour, working time, lb.	6,310	5,713	6,012
Coal as fired per sq. ft. of grate per hour, lb.	74.85	67.77	71.31
Coal as fired per 100 ton-miles	6.59	5.95	6.27
Coal as fired per i.hp. hour, incl. auxil., lb.	2.89	2.56	2.72
Coal as fired per i.hp. hour, less auxil., lb.	2.81	2.47	2.64
Efficiency, combined, total B.t.u. in steam, divided by total B.t.u. in fuel	75.94	79.21	77.58
Total average i.hp. of locomotive	2,180	2,228	2,204
Average i.hp., right cylinder	722.4	722.1	722.3
Average i.hp., middle cylinder	764.2	803.9	784.0
Average i.hp., left cylinder	693.4	702.0	697.7
Maximum i.hp.	3,035	2,896	2,966
At a speed of, miles per hour	29	46	37.5
Average cut-off of locomotive, per cent of stroke	63.8	52.4	58.1
Average gage pressure at steam chest, lb.	174.0	176.0	175.0
Average initial pressure, lb.	171.5	172.0	171.8
Average mean effective pressure, lb.	120.2	99.2	109.7
Average least back pressure, lb.	13.7	11.9	12.8
Average back pressure at point of compression, lb.	15.6	14.5	15.0



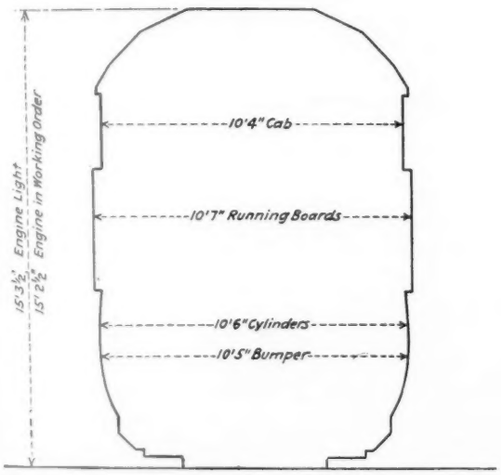


The Chesapeake & Ohio is Receiving 25 of These Powerful Simple Mallet Locomotives

Chesapeake & Ohio 2-8-8-2 Simple Mallet

Articulated Locomotive of 103,500 Lb. Tractive Force Designed to Meet Restricted Clearances

ONE of the most interesting of recent locomotive designs is that of the Chesapeake & Ohio 2-8-8-2 type single expansion Mallets, of which 25 are being delivered by the American Locomotive Company. The C. & O. has employed Mallet locomotives for a number of years, but these have been of the 2-6-6-2 type, 45 of which were placed in service during the period of the United States Railroad Administration. Practically all of the freight tonnage on the main line through the Allegheny mountains has been handled with these light Mallet type locomotives. When the new 2-8-8-2 type locomotives are placed in service on the



Restricted Clearance Lines to Which the C. & O. Mallet Design Was Required to Conform

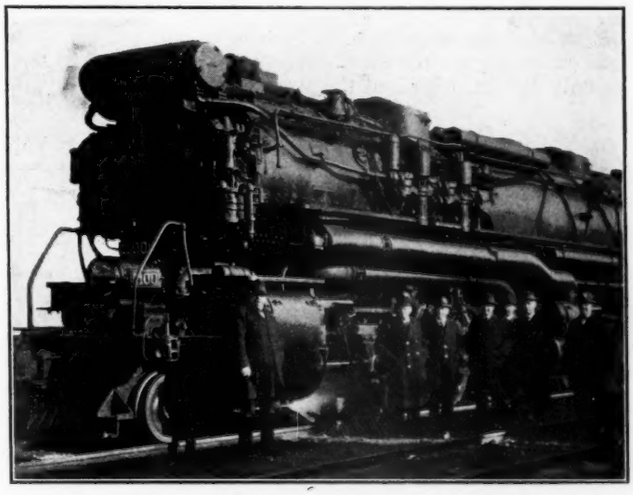
Mountain division, it is planned to extend the use of the lighter Mallets to the lower grade portions of the line where very heavy coal trains are successfully handled with relatively long runs. The C. & O. has a large equipment of high capacity steel coal cars, which makes it possible to assemble very heavy trains near the mining fields. These trains have to be hauled over the mountains and then through relatively level country to the seaboard. The new power will permit a material increase in the train load and make it possible to haul such trains through to the seaboard without breaking and reassembling.

The tunnels and restricted clearances on the C. & O. have prevented the use of the heavier type articulated locomotives of the usual design. The problem presented was therefore that of designing as powerful a locomotive as possible without exceeding the clearance limitations. As space was not available for compound cylinders, the very unusual practice of making all four cylinders high-pressure, single-expansion was adopted. While the almost universal practice in Mallet locomotives is to use double expansion, the Pennsylvania has had in operation for several years one large 2-8-8-0 simple Mallet with limited cut-off and a few small simple Mallets have been built at various times for export or industrial service. This is the first instance, however, in which any considerable number of large articulated locomotives of the single-expansion type have been built.

Another important consideration, which led to the unusual design of these locomotives, was the desire to operate them at higher running speeds than experience has shown to be practical for heavy compound articulated locomotives. By increasing both train loads and operating speeds, the maximum increase in traffic capacity could be obtained.

The new C. & O. engines, known as Class H-7, or Chesapeake type, and numbered from 1100 to 1124, are remarkable for their power, large boilers and compact, carefully worked out design. The maintenance of Mallet locomotives used in heavy service has always been considerable of a problem. This has been met on the C. & O. by organizing special repair gangs at all terminals and giving prompt attention to the features requiring attention without postponing work until the locomotive was removed from service for extensive repairs. Having had an extended experience with a considerable number of Mallet locomotives, it very properly followed that in making an entirely new design, careful attention was given to details so as to reduce attention and maintenance expenses to the lowest point possible.

These locomotives are practically two Consolidation engines with only one boiler. They measure 109 ft. 3⅜ in. from the front of the engine to the rear of the tender and have a total weight of 775,000 lb. in working order with the tender loaded. The distribution of the weight is as follows: 32,000 lb. on the front truck; 251,500 lb. on the forward set of drivers; 239,500 lb. on the second set of drivers, and 42,000 lb. on the trailing truck, making the total weight of the



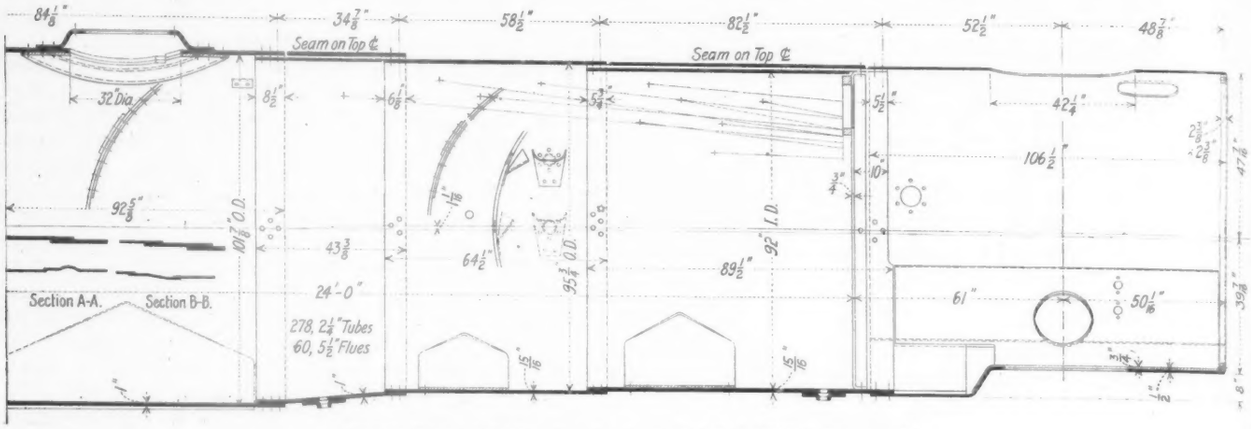
Inspecting the First Locomotive: W. J. Harahan, President; G. B. Wall, Vice-President; R. N. Begien, Vice-President (Operation); J. B. Parrish, General Manager; L. B. Allen, Superintendent Maintenance of Way; C. W. Johns, Chief Engineer and G. H. Langton, General Master Mechanic

engine alone 565,000 lb. The engine alone is 70 ft. 1⅝ in. long. The driving wheel base of each unit is 15 ft. 9 in., the engine wheel base is 58 ft. 1 in., and the total wheel base of the engine and tender is 98 ft. ⅜ in. All four cylinders are 23 in. in diameter with a 32-in. stroke. The driving wheels are of 57 in. diameter and the rated tractive force of the locomotives is 103,500 lb. They are designed to operate on 20 deg. curves and on grades up to 1½ per cent.

In this connection it is of interest to note that the Class H-6, compound 2-6-6-2 type, Mallets hitherto used on the C. & O., weigh 441,000 lb., of which weight 368,500 lb. are on the drivers. The driving wheel base of each unit is

10 ft., the engine wheel base is 48 ft. 10 in. and the total wheel base of engine and tender is 86 ft. 11¾ in. The cylinders are 22 in. and 35 in. by 32 in., the driving wheels 56¼ in. diameter, the steam pressure 200 lb. and the rated tractive force 94,000 lb. simple, and 74,200 lb. compound.

The boilers of the new Class H-7 Mallets are of an exceedingly interesting design and are the longest ones ever built at the Schenectady plant of the American Locomotive



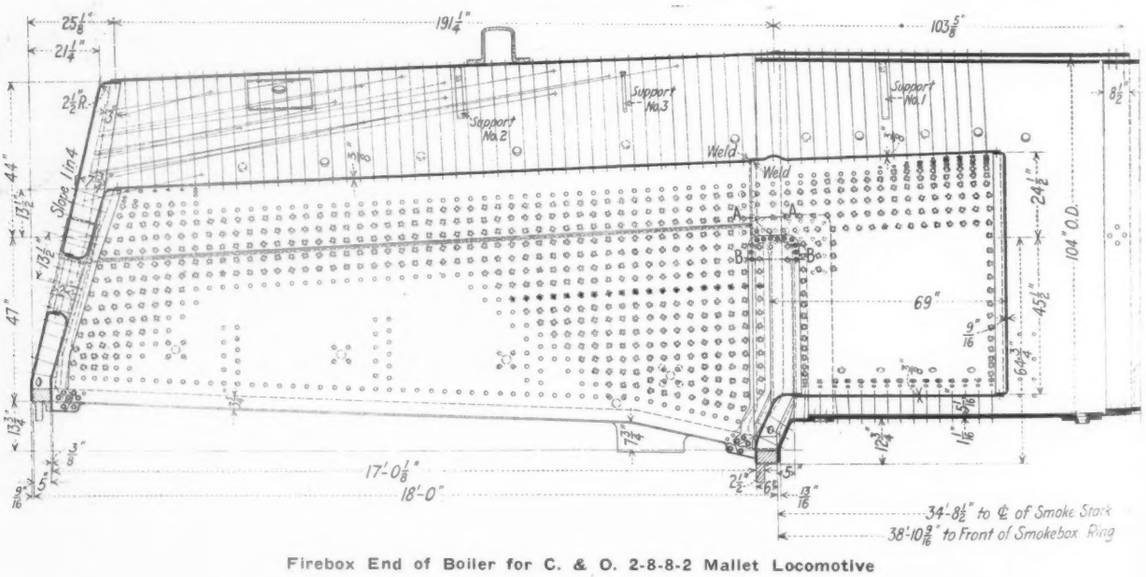
Front End of Boiler for C. & O. 2-8-8-2 Mallet Locomotive

Company. The length from the front of the smokebox ring to the back end of the mud ring is 56 ft. 11⅛ in. The shell of the boiler, which is of the straight top type, consists of five courses, not including the smokebox or the firebox wrapper sheet. The inside diameter of the first course is 92 in. and the outside diameter of the course back of the dome is 104 in. diameter. The photograph of the locomotive as well as the drawings show that every available inch was used without exceeding the restricted clearances allowable. The dome is only 5½ in. high and the stack extension is but 11½ in.

this be found advisable. There are 278 tubes, 2¼ in. diameter and 60 flues, 5½ in. diameter, the length being 24 ft. There is 6,443 sq. ft. of evaporative heating surface, 467 sq. ft. being in the firebox and 5,976 sq. ft. in the tubes and flues. The heating surface of the 60 units of the Type A superheater is 1,885 sq. ft. According to Cole's proportions, the rated cylinder horsepower is 3,902 hp. and that of the boiler 3,677 hp., or 94.2 per cent. This does not include any allowance for the effect of the two Elesco feedwater heaters, with which all these locomotives are equipped.

The firing is done with a Duplex stoker, which is here called on to perform what is probably the most strenuous work ever demanded of it. The estimated coal consumption at the rate of 3¼ lb. per cylinder horsepower hour is 12,682 lb., or at the rate of 112.9 lb. per square foot of grate per hour.

The ash pan is of the self-cleaning hopper type and so designed that it can be taken down without removing the



Firebox End of Boiler for C. & O. 2-8-8-2 Mallet Locomotive

The provision of ample boiler capacity is one of the conspicuous features of the design. Upon sufficient steaming capacity depends the ability to maintain the speed with trains which the locomotive was designed to haul. The wide firebox is 204⅛ in. long and 96¼ in. wide. It is fitted with a Gaines firewall and has a grate area of 112.9 sq. ft., 169 in. by 96¼ in., for burning soft coal. There is also a combustion chamber 69 in. long. Arch tubes are not used, although provision was made for their future application should

trailing wheels. It is built of ¼-in. steel and provision is made for washing down the sides while running. The air space through the ash pan dampers is 90 per cent of the gas area through the tubes and flues.

There are many interesting features about the boiler design, some of which are quickly apparent from an examination of the drawings. There is a large amount of exceptionally fine welding on the boilers. The welded joints include the long seam between the crown sheet and the firebox side sheets and

also between the combustion chamber and the firebox. At the joint the sheets are beveled ⅛ in. and lapped ½ in. with a weld on both sides, as shown in the detail drawing. At the junction of the combustion chamber and the firebox, a corrugation is provided, as shown in the drawings, this to better care for the expansion at this point.

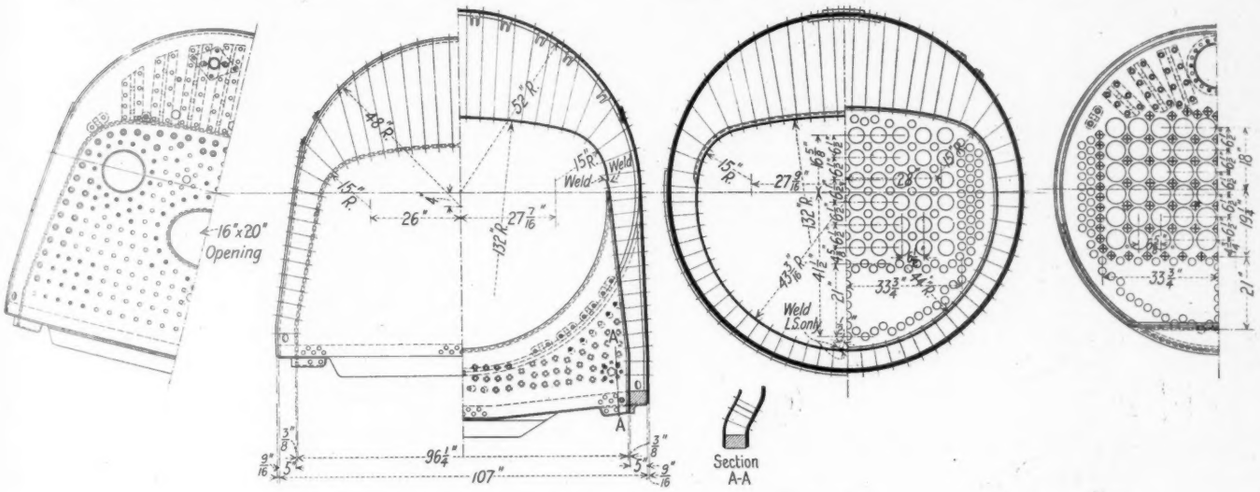
The rated tractive force at 85 per cent with the four 23-in. by 32-in. cylinders, 57-in. driving wheels and 205 lb. steam pressure, is 103,500 lb. The steam is controlled by 14-in. piston valves operated by Walschaert valve gear. The reverse gear is the Alco, Type E. The cylinders are fitted with Mellin by-pass valves and vacuum relief valves.

Carbon-vanadium steel is used for the main and side rods, the crank pins, the piston rods, the wrist pins, the valve motion parts and also for the leading and trailing truck axles as well as the driving axles. The piston is of forged steel. The main driving axles, which have 11½ in. by 13 in. journals and the other driving axles, which have 11 in. by 13 in. journals, are all hollow bored. The frames are of vanadium cast steel, furnished by the Union Steel Castings Company.

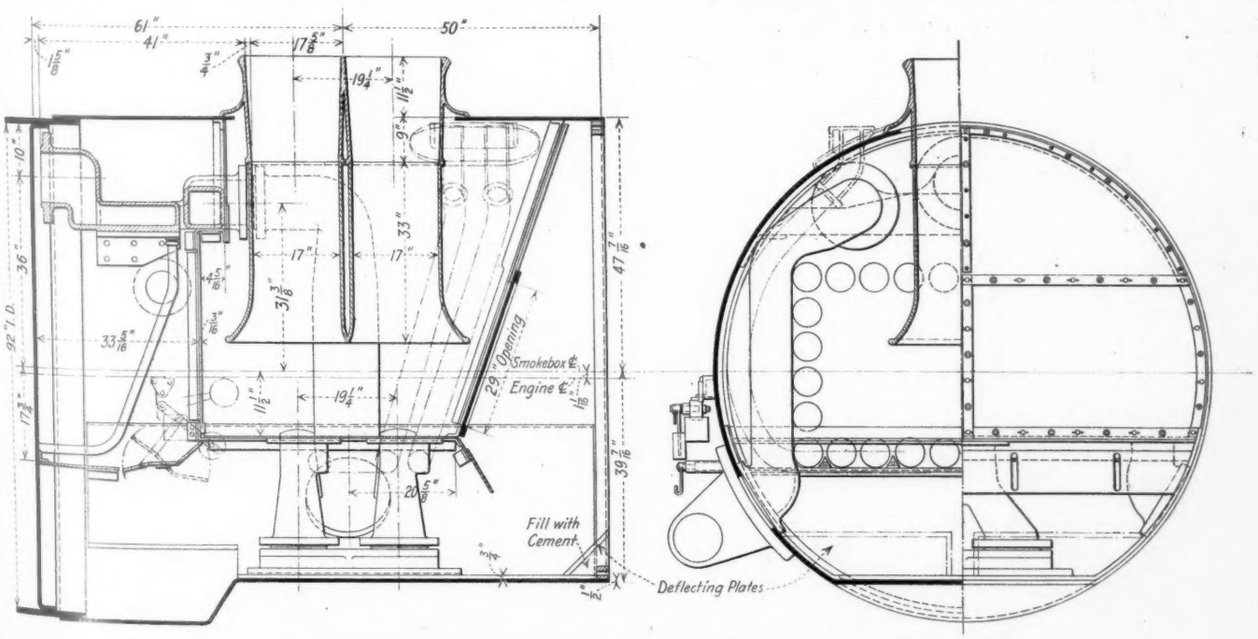
The leading truck is of the Commonwealth "Economy" constant resistance type. The trailing truck is of the Delta type. Engine truck, trailing truck and tender truck wheels are of forged steel, furnished by the Forged Steel Wheel Company.

The throttle in the dome is of the American Locomotive Company's design, top-lift type with a pilot valve. The dry pipe is 9½ in. inside diameter, ¼ in. thick. An unusual feature is that of the slipping throttle with a choke resembling a stove pipe damper in the rear unit exhaust pipes and the front unit steam pipe. These are operated by an air cylinder mechanism shown in one of the illustrations, independently controlled by three-way air valves located in the cab.

The smokebox front end is made in three sections. The feedwater heater is mounted on the top section. The lower sections are divided vertically. An 8½-in. cross-compound air compressor is mounted on each of these sections, which are arranged to swing out with the air compressor on Okadee hinges. A center plate is also provided which permits of access to the front end without disturbing the air compressors or the feedwater heater.

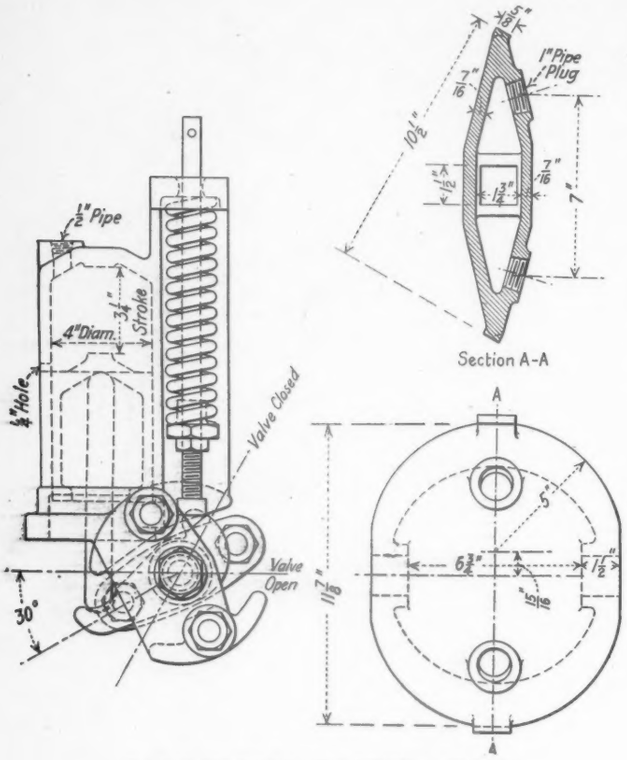


Back View and Cross-Sections of the C. & O. Mallet Boiler



Smoke Box Construction Showing Design of Double Stack, One for Each Engine Unit

The headlights, Pyle-National Type K-2, operated by a turbo-generator, are placed down near the bumper beams. These locomotives will be operated through a number of tunnels, some of which are quite long. A noteworthy feature



Control Mechanism for Slipping Throttle

is the provision that has been made for the comfort of the enginemen while passing through these tunnels. As a result of extended tests made by the mechanical department of the C. & O., assisted by experts from the Bureau of Mines, Department of the Interior, two steel fan blowers, Buffalo Forge Company's size No. 2, were installed under the cab deck, one on each side. They are driven independently by Pyle-National, Type K, headlight turbines. The inlet air pipes lead back to the space between the engine and tender with the discharge pipes leading up into the cab. This arrangement provides a stream of comparatively pure air and at the same time reduces the temperature in the cab. As a further precaution, three gas masks are provided. These receive their air supply from the main reservoir. Moreover the back boiler head is lagged down to the deck and all cab steam pipes covered with Unarco Asbestos Insulate.

The tender is of the Vanderbilt type and holds 12,000 gal. of water and 15 tons of coal. It is mounted on a single-piece, cast steel frame. The trucks are of the four-wheel type with Andrew's cast steel side frames and cast steel bolsters furnished by the American Steel Foundries. The tender coupler is a Type D with 6-in. by 8-in. shank and 5¼-in. butt. The draft gear is a Miner A-18-S-2, with Farlow two-key attachments. A Franklin unit safety drawbar connects the locomotive and tender.

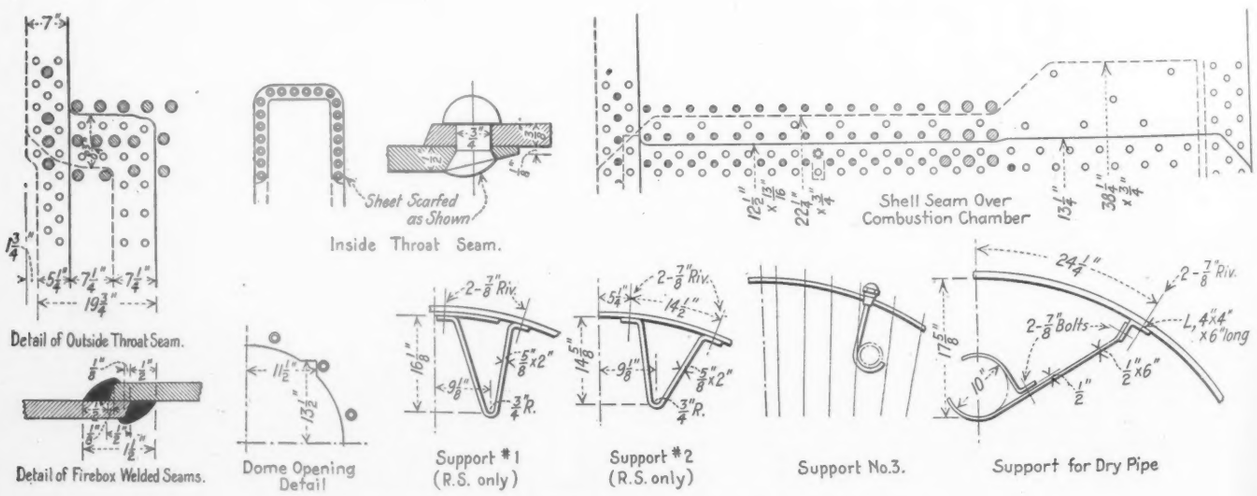
Some difficulty was experienced in finding a space for the main reservoirs of the Westinghouse air brake system. This was finally taken care of by using three reservoirs, one 14-in. by 144-in. on the right-hand side, one 14-in. by 108-in. on the left-hand side and one 14-in. by 120-in. near the top of the boiler. The total reservoir capacity is 70,696 cu. in.

Among the specialties the following, not previously mentioned, are included: Hancock non-lifting Type K injectors having a capacity of 9,000 gal. per hour, and accompanied by 3-in. check valves; three 3½-in. Consolidated safety valves, two open and one muffled; Okadee 2-in. Type FH blow-off cocks; Okadee WG 13 water gages; Franklin grate shaker and No. 8 firedoor; Nathan eight-feed lubricator; Graham-White sanders; Detroit flange oilers; United States Metallic packings for piston rods and valve stems; Hunt-Spiller gun metal bushings for cylinders and valve chests; and Barco flexible joints in air lines between engine and tender and screw type flexible joints in main reservoir pipes.

The general dimensions and proportions of these interesting locomotives are given in an accompanying table.

TABLE OF DIMENSIONS, WEIGHTS AND PROPORTIONS

Railroad	C. & O.
Builder	American Loco. Co.
Type of locomotive	2-8-8-2 Simple
Service	Freight
4 cylinders, diameter and stroke	23 in. by 32 in.
Valve gear, type	Walschaert
Valves, piston type, size	12 in.
Maximum travel	6 in.
Outside lap	1 in.
Exhaust clearance	0
Lead in full gear	1/8 in.
Weights in working order:	
On drivers	491,000 lb.
On front truck	32,000 lb.
On trailing truck	42,000 lb.
Total engine	565,000 lb.
Tender	210,000 lb.



Some Details of the Boiler for the C. & O. Mallet Locomotive

Wheel bases:	
Driving, each	15 ft. 9 in.
Rigid, each	15 ft. 9 in.
Total engine	58 ft. 1 in.
Total engine and tender	98 ft. ⅜ in.
Wheels, diameter outside tires:	
Driving	57 in.
Front truck	30 in.
Trailing truck	42 in.
Journals, diameter and length:	
Driving, main	11½ in. by 13 in.
Driving, others	11 in. by 13 in.
Front truck	6½ in. by 12 in.
Trailing truck	8 in. by 14 in.
Boiler:	
Type	Straight ton
Steam pressure	205 lb.
Fuel	Bituminous coal
Diameter, first ring, inside	92 in.
Firebox, length and width	204⅛ in. by 96¼ in.
Height mud ring to crown sheet, back	60½ in.
Height mud ring to crown sheet, front	89¼ in.
Combustion chamber length	69 in.
Tubes, number and diameter	278–2¼ in.
Flues, number and diameter	60–5½ in.
Length over tube sheets	24 ft.
Grate area 169 in. by 96¼ in.	112.9 sq. ft.
Heating surfaces:	
Firebox and comb. chamber	467 sq. ft.
Tubes	3,912 sq. ft.
Flues	2,064 sq. ft.
Total evaporative	6,443 sq. ft.
Superheating	1,885 sq. ft.
Comb. evaporative and superheating	8,328 sq. ft.
Tender:	
Style	Cylindrical
Water capacity	12,000 gal.
Coal capacity	15 tons
Trucks	Four-wheel
General data estimated:	
Rated tractive force, 85 per cent	103,500 lb.
Cylinder horsepower (Cole)	3,902 hp.
Boiler horsepower (Cole) (est.) *	3,677 hp.
Speed at 1,000 ft. piston speed	31.8 m.p.h.
Steam required per hour	81,162 lb.
Boiler evaporative capacity per hour *	76,472 lb.
Coal required per hour, total	12,682 lb.
Coal rate per sq. ft. grate per hour	112.9 lb.
Weight proportions:	
Weight on drivers ÷ total weight engine, per cent	86.9
Weight on drivers ÷ tractive force	4.91
Total weight engine ÷ cylinder hp	147.1
Total weight engine ÷ boiler hp	156.1
Total weight engine ÷ comb. heat. surface	67.9
Boiler proportions:	
Boiler hp. ÷ cylinder hp., per cent *	94.2
Comb. heat surface ÷ cylinder hp	2.13
Tractive force ÷ comb. heat. surface	12.42
Tractive force × dia. drivers ÷ comb. heat. surface	708
Cylinder hp. ÷ grate area	34.5
Firebox heat. surface ÷ grate area	4.40
Firebox heat. surface, per cent of evap. heat. surface	7.72
Superheat. surface, per cent of evap. heat. surface	29.25

* No allowance for feedwater heaters included.

Paris-Orleans Condensing Locomotive

Means Adopted on Suburban Tank Locomotive for Condensing Exhaust Steam While Passing Through a Long Tunnel

By H. Leflot
Inspector of Equipment, Paris-Orleans Railway

THE Paris-Luxembourg line to Sceaux and Limours runs well into the City of Paris and passes through a tunnel, a little over a mile long, situated between the stations of Paris-Luxembourg and Paris-Denfert. When the line was built it was apparent that certain measures must be taken to avoid inconvenience to the passengers from the escaping smoke and steam of the locomotive during the passage through the tunnel.

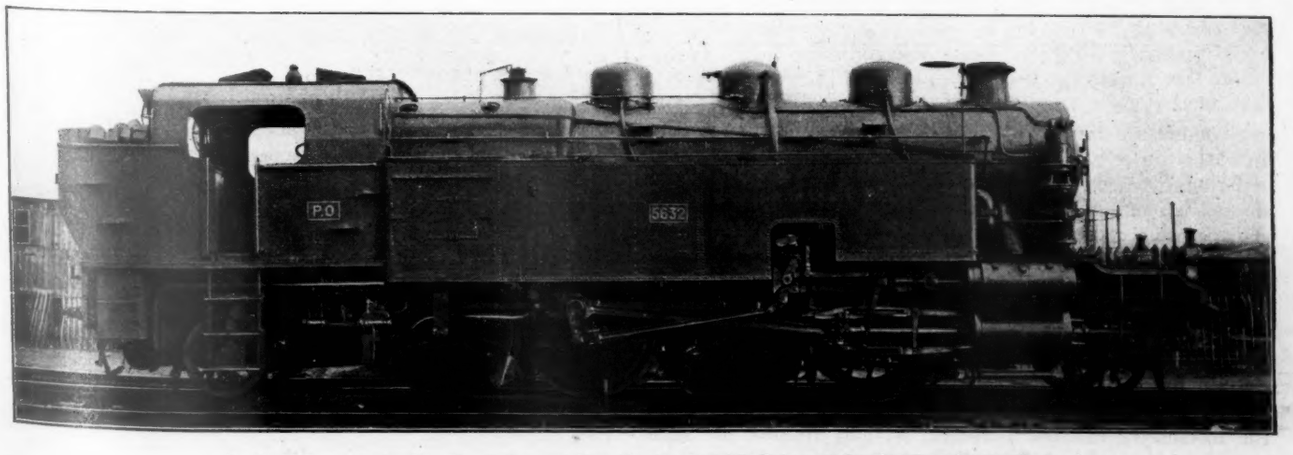
Black smoke could be done away with by special care in the control of the fire, but the question of the exhaust steam remained. To overcome this trouble, the Paris-Orleans railroad equipped a locomotive with an arrangement for condensing in the water tank as much of the exhaust steam as possible.

On the first locomotive equipped with condensing apparatus the boilers were fed by injectors. Upon reaching the end of the tunnel at Denfert, it was found necessary to partly empty the tanks and replace the hot water by cold water taken at the water crane, in order to obtain a sufficiently low temperature to secure reliable action of the injectors.

Furthermore, to insure a supply of water to the boiler during the time the condensing apparatus was in operation, a supplementary cold water tank, having a capacity of 106 gallons, was employed. This tank was so arranged that it could be placed in communication with the ordinary tanks or held in reserve until needed.

This method of operation wasted a considerable amount of water and fuel and caused an undesirable loss of time between stations only a short distance apart, where quick service was important.

The original locomotives having become incapable of making the running time with the increasing traffic that had to be handled, it was decided to replace them by more power-



Paris-Orleans Suburban Tank Locomotive Equipped with Exhaust Condensing Apparatus

ful tank locomotives of the 2-8-2 type fitted with superheaters. At this time, in order to do away with the inconveniences mentioned, we developed a new condensing apparatus and applied two Worthington pumps for feeding the boiler. This permitted using the water in the tank at all times no matter what the temperature might be.

Description of the Condensing Apparatus

As will be noted from the drawings, this apparatus is a sort of surface condenser. It consists of copper exhaust pipes *C*, brass pipes, *E*, for condensing the exhaust or discharging above the water in the tank any steam that has not been condensed, also copper pipes, *G*, which permits the final escape to the atmosphere of the non-condensed steam if any still remains.

The waste pipes are two in number; the main waste pipe, *K*, terminates underneath the coal box and has at the end a double elbow, which forms a trap to prevent the escape of the non-condensed steam in the pipe *E*. The other pipe, K^1, discharges the water of condensation between the first and second pair of driving wheels.

To permit the utilization of the apparatus at will, a control valve, *A*, is placed in the exhaust pipe of each cylinder. Both of these valves are operated by the handle, *J*, located conveniently for the engineman. This permits the directing of the exhaust steam into the water tanks or to the atmosphere by way of the stack.

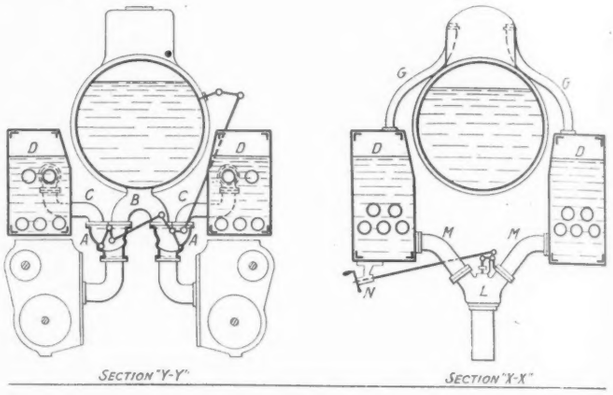
The two water tanks, *D*, are connected by the cross-over pipe, *M*. They can be emptied by a valve, *L*, operated by the handle, *N*, shown in the cross section. There is also a pipe, *S*, connecting the front and the back portion of the tank to secure a circulation of water and to divide the heat evenly throughout the tank.

Operation of the Device

By suitably adjusting the valves, *A*, by the handle, *J*, communication is established between the exhaust pipe and the condensing apparatus. The exhaust steam is then directed into the pipes, *E*, and there partly condensed, while the remainder passes out by the top extension, *F*, to be condensed by contact with the surface of the water in the tanks. Any surplus of steam not condensed escapes in the atmosphere by the vent pipe, *G*, and the water of condensation passed away by the waste pipes, *K* and K^1, as shown on the elevation drawing of the locomotive.

By means of cocks, suitably located, the engineman may divert the exhaust steam from the feedwater pumps either to the atmosphere or to pipes leading to the water tanks. The exhaust steam from the air compressor is piped to one of the locomotive exhaust passages, *A*, and follows the same course as the exhaust from the main engine cylinders.

The cover, *H*, of the water tank is kept tightly closed to avoid the escape of the steam and projection of water on to the tracks. The volume of water contained in the tanks at the maximum level, which is indicated by a gage cock placed on a partition on the side of the tank, is 212 cu. ft., or 1,585 gallons. The maximum level is at 13½ in. from the top of the reservoir. Should this level be exceeded and a surge of water caused by the motion of the locomotive reach the top of the condensation pipe, the surplus would pass off by the waste pipes, *K* and K^1, following a course the reverse of the one taken by the condensed steam outlined in the preceding paragraph.

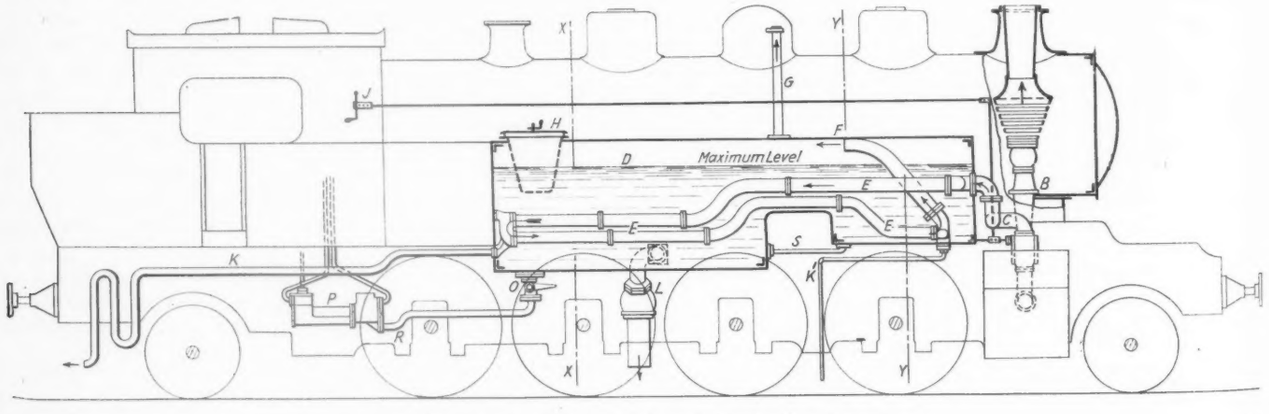


Cross Sections

Summary

It is apparent from what has been stated that the exhaust steam condensing apparatus of the new tank locomotive on the line between Paris and Limours has succeeded in solving the particular problem of the suppression and the escape of the exhaust steam to the atmosphere during the passage through the tunnel.

Economy of fuel was not the object aimed at. There is no doubt, however, that the condensing apparatus results in some saving due to the heating of the feedwater, but this saving is small inasmuch as the condensing apparatus functions only between the two stations of Denfert and Luxembourg, less than a mile apart. When it functions and all the exhaust steam is sent into the water tanks, the draft is almost completely extinguished and the use of the blower becomes necessary. This reduces the economy resulting from the recovery of the heat contained in the exhaust steam from the cylinders.



Elevation Showing Water Tank and Condensing Apparatus

Encouraging Apprentices by Competitive Methods*

Boys Should Be Checked Up Periodically to Make Sure They Have Mastered the Various Classes of Work

By Earl D. Austin
Machinist Apprentice, Chicago, Milwaukee & St. Paul, Galewood, Ill.

IN my opinion the four-year training plan is not the correct method to produce good mechanics. Most any boy can pass the first examination and enter his apprenticeship. Then he serves his time and becomes a machinist whether he is a dependable one or not. This system makes the goal of the boys the time they have left to serve—not the kind of mechanics they are going to make.

What would the schools of our country be if the boys and girls were graduated after four years, regardless of whether they had acquired the necessary knowledge or not. I do not think they would be of much account; schools are not run on that plan. A boy passes an examination to enter high school and then after each course he has to pass an examination to prove that he thoroughly understands the subject and he is graded accordingly. Is not the apprentice a scholar just as is the high school boy?

There is nothing that makes a boy study and work harder than trying to get ahead of the other fellow and be ahead in his monthly markings. The apprentice boy should be rated on a percentage basis every month and it should be posted on the bulletin board. When a boy heads the list it makes him feel proud and determined to stay at the top of the list, while those at the bottom are ashamed and will try hard to crawl to the top. There is nothing that makes a boy more determined to win than a contest of this sort. I could hardly wait until the names and percentages were posted to see how I ranked among my fellow apprentices. These percentages should not be marked by the foreman alone, but by the apprentice instructor, if one, and also the mechanic the boy is working under.

Earl D. Austin

The boy should also pass an examination and show the foreman that he understands the job thoroughly before he is allowed to go to another class of work. Suppose, for instance, the boy is running a lathe; when he has been on it four months, or the specified time, he should show the foreman that he can operate the lathe correctly before he is allowed to work on another machine. He should also pass a written examination on the operation of the lathe and such questions as the number of threads to the inch, the taper of standards parts, etc. If the boy passes the examination, he should be put on another class of work; if not, he should stay on lathe work until he can pass the examination satisfactorily. If he is a good mechanic he will pass from one class of work to another regularly. If not he should give up and try some other trade. As it is now, the boys all go on regardless of their qualifications. These examinations will also encourage the boy to study at home to finish his apprenticeship sooner.

The average apprentice of today figures that there is no use in studying, as he will be a mechanic in four years, whether he studies or not. It is not right for the management to turn out a poor mechanic from the shops, as he will never succeed in life by working at a trade not properly mastered. It is far better to discharge the boy and let him pick a trade he is better suited for.

If the system above suggested was followed there would not be as many poor mechanics in the country who cannot hold their jobs; these men go from job to job and are always an expense to the railways which hire them. There would probably be a few less mechanics in this country, but you would know when you hired one that you were hiring a first-class mechanic who would make money for the company; you would not have to find a job to which he was suited, but could give him any job.

Competition is what has made our country so progressive. Would we have the easy-riding steel coach and the powerful locomotive that takes us across the country at the rate of 60 miles an hour if it was not for competition? No! We would be riding in the hard-creaking wooden coach drawn by the slow-moving locomotive. If competition will make good railways it will make good mechanics; so the more competition a management can promote among their apprentices, the better mechanics they will produce.

If this system of training apprentices was taken along with the schooling and social system on the Santa Fe, this country would be better equipped to take care of its motive power.

A SMALL BOY said that a gun was dangerous without lock, stock or barrel, because his daddy licked him with the ramrod. Careless men find ways to hurt themselves anywhere, while careful men can do hazardous work all their lives and never get a scratch. —The Night Watchman.

*Awarded honorable mention in the competition for regular apprentices which closed Sept. 1, 1923.

Elimination of Errors in Stephenson Valve Motion

A Detail Method Is Given for Determining the Offset of the Link Saddle Pin and the Principal Factors in Design Are Discussed

By Roy C. Beaver
Assistant Mechanical Engineer, Bessemer & Lake Erie, Greenville, Pa.

THERE are several sources of error inherent in the design of the Stephenson valve gear as applied to locomotives, which, unless compensated for, cause the valve events to occur at different times on the forward and backward strokes, thus making the valves out of square. The three principal sources of error, and the only three which it is customary to overcome in the design, are the angularity of the main rod, the angularity of the eccentric blades and the fact that the eccentric blade pins are not placed on the link arc, but, on account of the construction of the link are set some distance inside.

The effect of the first two of these errors is to cause the link block, and hence the valve, to lag behind the proper positions, with respect to the piston position, during the backward stroke of the piston and to the link block, and hence the valve, to run ahead during the forward stroke of the piston.

The effect of the third of these errors is just the opposite. The valve is caused to lag behind its proper position during the forward stroke and to run ahead during the backward stroke of the piston.

The effects of the first two errors are thus added together and counteracted by the effect of the third error, but the effect of the third error does not entirely compensate for the combined effect of the first two. Therefore, an additional condition must be introduced which will complete the compensation. This additional condition is the back-setting of the link saddle pin from its theoretical position on the link arc to a point inside of the link arc.

WHAT is the correct offset of the link saddle pin on a Stephenson valve gear? Can you give a detailed method of determining this offset? The answer to this question, asked by a reader, is contained in Mr. Beaver's article. The offset referred to in the discussion, indicated by the question mark shown on the drawing of the link, is the means used to compensate for errors existing in the valve gear design. Although the Stephenson gear is rarely installed on new equipment, it is a well-known fact that a large number of shop men have to deal with it on the older locomotives. If an old Stephenson gear is causing you trouble perhaps you will find the reason here.

Angularity of the Main Rod

The manner in which these errors are introduced and the effects produced upon the link are shown in the accompanying diagrams. Fig. 1 shows the effect produced by the angularity of the main rod. Ordinarily when we think of main rod angularity, we think of the erratic motion it produces upon the piston. However, we must consider the piston to have a true motion and the error to be developed at the crank pin end. The point A shows the position of the crosshead wrist pin when the piston is at the middle of its stroke. The length of the main rod is AO. Therefore, the arc BOB', described through the point O with the radius AO, shows that at mid-stroke the crank pin is at the point B for the bottom quarter, instead of at C, and for the top quarter is at the point B' instead of at C'. The distance CB then represents the amount the crank pin lags behind its proper position at the bottom quarter and the distance $C'B'$ represents the amount the crank pin runs ahead at the top quarter. This error is zero at the front and back dead centers, and is greatest at the quarter positions; that is, it increases from zero to maximum through 90 deg. and back to zero in the next 90 deg. Thus, as noted above, the crank pin, and hence the link, lags behind the proper position during the backward stroke of the piston and runs ahead during the forward stroke.

The result of this erratic motion is shown by the solid lines in Fig. 1. These lines show the position of the eccentrics, eccentric blades and link when the crank pin is at B. The dotted lines show the proper positions which these parts would have if the crank pin were at C. Neglecting for the moment the effect of the other two errors mentioned, it is seen that the center of the link is at D instead of D' and the link block is at E instead of E', the distances DD' and EE' representing the amounts the link center and link block lag behind their proper positions during a backward stroke of the piston. The link is then traveling in the direction of the arrow. This lagging of the link block, transmitted to the valve, causes the valve events to be retarded at the front port during the backward stroke. By completing the diagram for the top quarter position, it may be shown that the valve events are hastened at the back port for the forward stroke.

Fig. 2 shows the effect produced on the link by the angularity of the eccentric blades. Neglecting for the moment the effect of the angularity of the main rod and the effect of the back-set of the eccentric blade pins, when the crank pin is at front center, the center of the link is at F. When the crank pin has moved through 90 deg. to the bottom quarter, the center of the link has moved the distance y to the position G. When the crank pin has moved through the second 90 deg. to back center, the center of the link has moved the distance x to the point H. It will be seen that the distance x is greater than the distance y, so that the center of the link has not moved equal distances for equal movements of the crank pin. Now when the crank pin passes through the third 90 deg. to top center, the center of the link moves back through the distance x to the point G', and when the crank pin completes the full revolution the center of the link will have moved back through the distance y to its starting point at F. The error thus increases from zero to maximum when the crank pin travels from 0 deg. to 180 deg., and the error decreases again to zero through the next half revolution.

The link must move faster in order to travel the distance x in the same time it travels the shorter distance y. This speeding up of the link at one end of the stroke causes the valve events to be out of time at the front and back ports. Assuming the engine to be running forward, it may further

be seen that the slow travel of the link occurs in the first and fourth quarters, or while the crank pin is traveling from the top quarter to the bottom quarter positions, and the piston is at the forward end of the stroke. At this time the blades are in open position and the angularity is the least. The fast travel of the link occurs in the second and third quarters, or while the crank pin is traveling from the bottom quarter to the top quarter positions, and the piston is at the back end of the stroke. It is in this phase that the blades are in crossed position, and the angularity is the greatest. This action causes the valve events to be slow at the front port and ahead of time at the back port. The effect is the same and must be added to the effect produced by the angularity of the main rod.

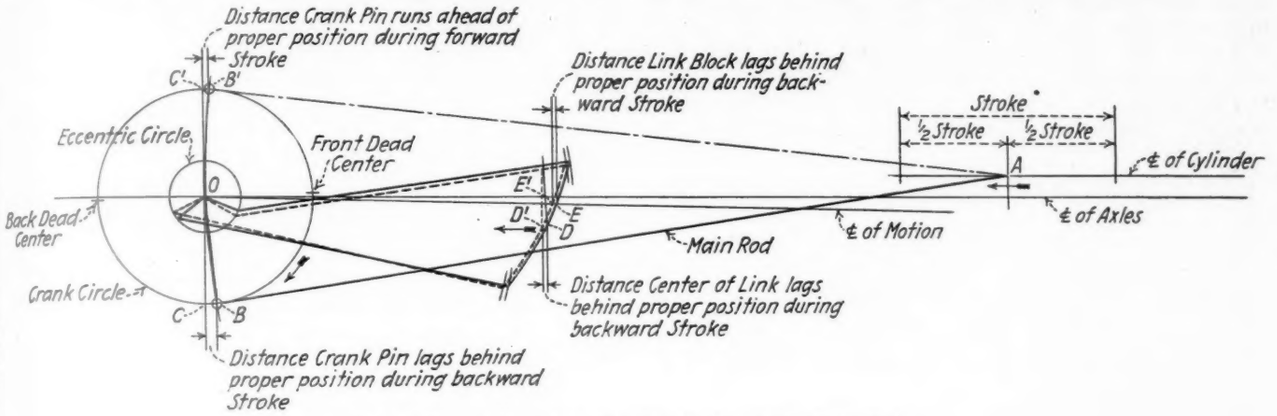
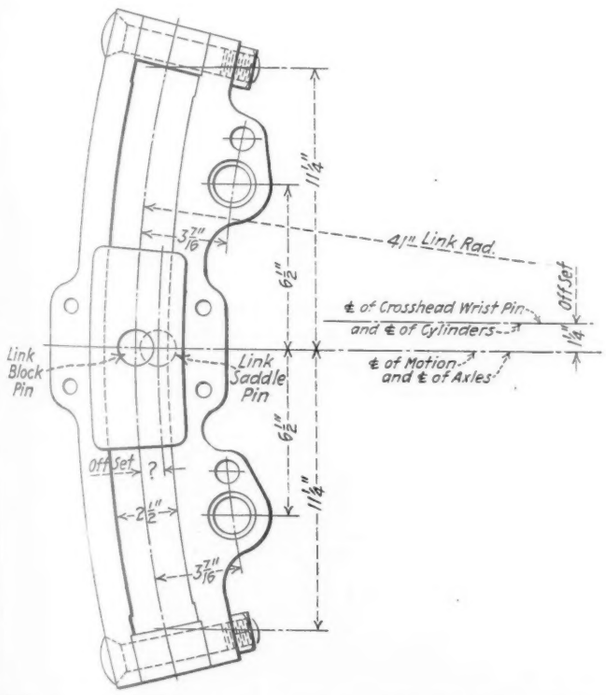

Distance Crank Pin runs ahead of proper position during forward Stroke
Distance Link Block lags behind proper position during backward Stroke
Stroke
½ Stroke
½ Stroke
Eccentric Circle
Front Dead Center
℄ of Cylinder
Back Dead Center
℄ of Axles
℄ of Motion
Main Rod
Crank Circle
Distance Center of Link lags behind proper position during backward Stroke
Distance Crank Pin lags behind proper position during backward Stroke

Fig. 1—Errors Caused by the Angularity of the Main Rod



Link on a Stephenson Valve Gear Showing the Offset of the Saddle Pin

Proper Positions of the Link Block

Fig. 3 shows the relation of the proper and the actual positions of the link if the effect of angularity has not been overcome. The effect of the error produced by the offset of the eccentric blade pins has been disregarded. J and K represent the actual positions of the link block at the forward and back link positions, respectively, while J' and K' represent the corresponding proper positions of the link. The point J is behind and the point K is ahead of its proper position. Now if the link could be raised vertically, there would be a point N on the link which would fall on J', and

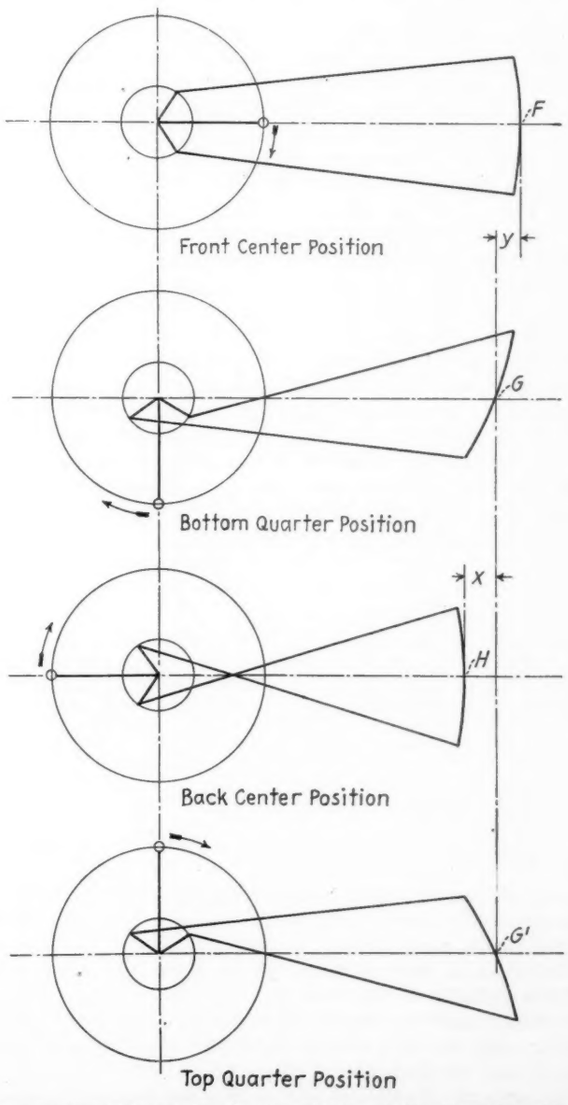


Fig. 2—Errors Caused by the Angularity of the Eccentric Blades

if the link could be lowered vertically, there would be a point M on the link which would fall on K'. Therefore, the link should be raised at the forward position and lowered at the back position. This is accomplished by offsetting the link saddle pin, which produces the effect shown in Fig. 4. The offset PQ acts as a lever about the point Q that raises and lowers the link through the distance z.

This brings the saddle pin outside of the link arc, but it is usual in locomotive practice to find it inside. The reason

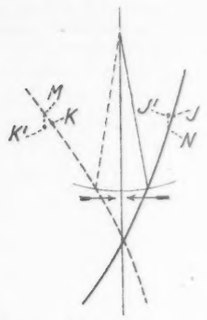


Fig. 3—Relation of Proper and Actual Positions of the Link Block

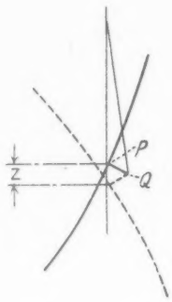


Fig. 4—Effect of the Method Used for Compensating for Angularity

for this is that the effect of the third error, which will now be discussed, is greater than the other two, and opposite in direction, so that in compensating for it, the saddle pin is brought back to a point within the link arc.

The effect of the third error, or the offset of the eccentric blade pins is shown in Fig. 5. The figure is drawn to show this error alone and neglects the effect of the other two. The solid lines show the actual positions of the eccentric blades and link and the dotted lines show their proper positions. The construction introduces a toggle joint which causes the link to be drawn toward the axle. The distances $US' + S'S''$ and $VT' + T'T''$ are equal to the distances US and VT respectively, and not being in straight lines, are greater respectively than the distances US'' and VT''. Hence the link is drawn toward the axle the distance RR'. The link is, therefore, always farther toward the back of the locomotive than it should be, so that when the link is traveling forward, it lags behind and when it is traveling backward it runs ahead of its proper position. The forward travel of the link occurs when the piston is in the back end of the stroke, and the backward travel occurs when the piston is in the forward

the drawing board, and the algebraic sum of these amounts could be taken as the net amount to move the pin. However, the required movement of the pin to compensate for all three errors may be determined at once by the method shown in Fig. 6. Make your decision as to the point of cut-off at which you desire the locomotive to be worked. Locate the positions of the crank pin as shown at X and Y, which have in Fig. 6 been located for a cut-off of 25 per cent. Then locate the positions of the eccentrics for each of these positions, as at p, p' and q, q'. If the angle $p\ o\ p'$ is not known from given dimensions of the locomotive, it may be determined by taking the horizontal distance w equal to the amount the lower end of the rocker arm moves. At the same time the top end of the rocker arm moves a distance equal to the lap plus the lead and then the angle $p\ o\ p'$ equals the angle ZOW. Next locate the link block ahead of and back of its central position a distance equal to the amount the lower end of the rocker moves when the upper end moves a distance equal to the lap, as shown at L and L'. Then from the given dimensions of the eccentric blades and link, locate these parts so that the link will pass through the points L and L'. There is only one position which the link can occupy to fulfill this condition for each position of the

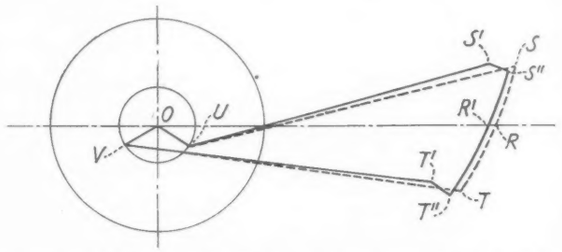


Fig. 5—Effect of the Back-Set of the Eccentric Blade Pins

crank pin. A paper template of the link will greatly assist in locating the link properly.

Through the middle points of the link in the two positions, draw the lines ab and cd perpendicular to the link arc. Evidently the saddle pin must be located somewhere on each of these lines and, at the same time, move in an arc about the center O', so that it will be located in a line gh, parallel to the center line of motion at the two link positions shown. We may then find by trial a location for the line gh parallel to the center line of motion, such that it will intercept the equal distances ef and mn from the link arc on the lines ab and cd respectively. These equal distances

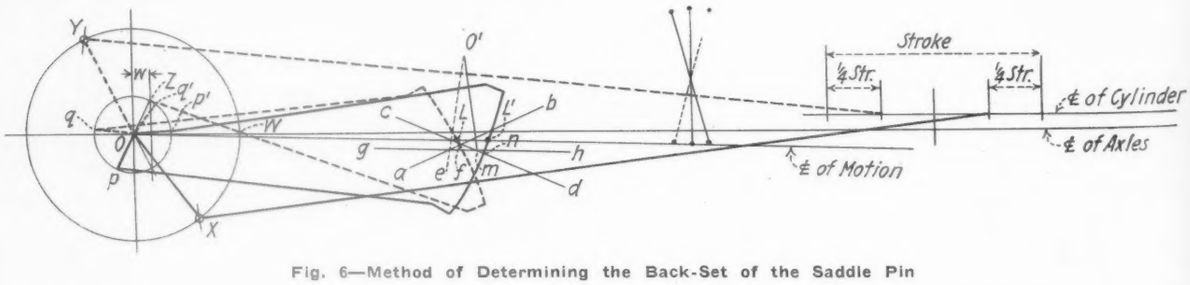


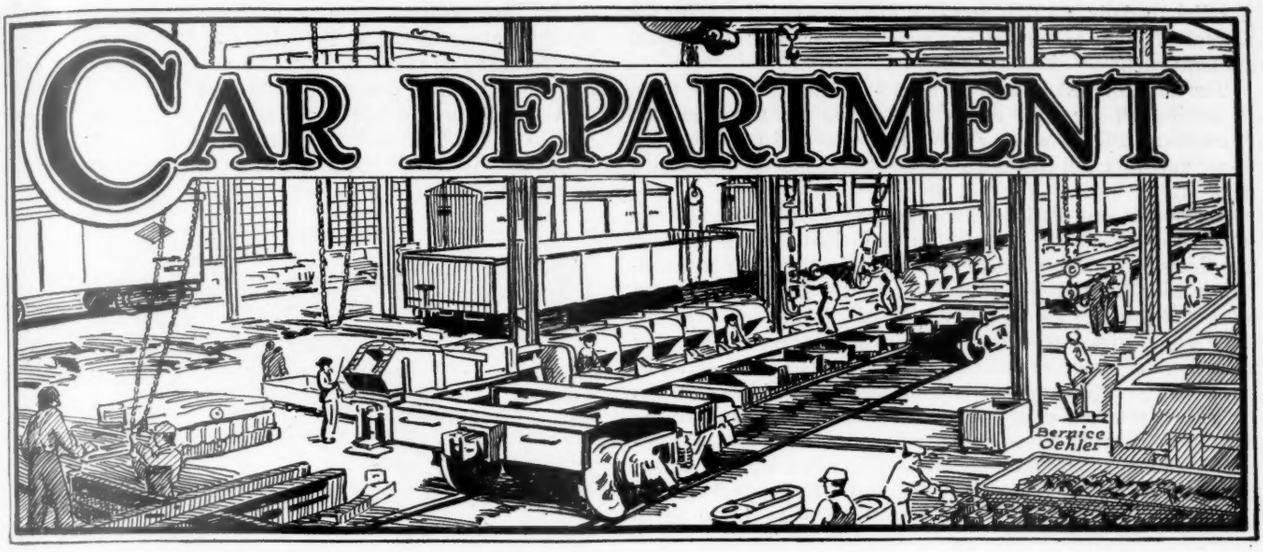
Fig. 6—Method of Determining the Back-Set of the Saddle Pin

end of the stroke, when the engine is running forward. Thus the valve events are slow at the back port and ahead of time at the front port.

The effect of this error is just the opposite of those due to the angularity of the main rod and the eccentric blades. This effect must be compensated for by just the opposite process; that is, by moving the saddle pin back to some point within the link arc.

The amount of offset of the saddle pin required to compensate for each error could be determined separately on ef and mn represent the back set of the link saddle pin.

Any location of the saddle pin will give proper valve events at only one point of cut-off, due to other errors which exist in the valve gear, and for this reason the back-set of the pin must be made such that the engine will be square at the point of cut-off where the locomotive is most likely to be worked. The other errors, however, are small and unimportant. Experience has shown that when the effects of the errors just described are eliminated, the locomotive is, for all practical purposes, a very smooth running machine.



Scrapping Steel Cars by Electric Arc Process

Facilities and Methods Which Are Applicable Where a Large Number of Cars Are To Be Handled

By A. M. Candy

General Engineering Department, Westinghouse Electric & Manufacturing Company

IN the past it has been the practice to turn steel cars ready to be scrapped over to wrecking companies or car builders. As a result many thousands of dollars profits have been made by such companies which could be made just as

Fig. 1—Interior of a Building Equipped with Traveling Resistors for Use in Cutting Up Steel Cars by the Arc Process

well by the railroads if they would make the necessary capital investment to do the work. A few of the roads have already investigated this question and have put in efficient equipment.

The problem of handling cars to be cut up is divided into two quite distinct fields, namely, reclaiming and scrapping. When a car is in such condition that the side stakes and underframe are in a satisfactory state of preservation, the car is a subject for reclamation, the work required being that of cutting rivets and bolts so that the defective plates and fittings can be removed readily and new material re-riveted in position. In many instances, however, the cars are in such poor condition that the only salvage will be trucks, air brake equipment and possibly center sills. Such a car, therefore, is a straight scrap problem and can be disposed of much less expensively by straight away cutting of plates, stakes, angles, sills and other parts.

There are three general methods employed for cutting up steel cars, namely, air guns or "rivet busters," oxy-acetylene cutting torches and the electric arc. It is not sufficient to say that any one of these processes is the best or the cheapest, because it will be found that there is a field for each. Insofar as the actual operating cost is concerned, the arc process, however, is actually cheaper. On one road the cost of cutting 200 rivets ¾ in. in diameter was found to be as follows:

Labor, 1 hr., 3 min. at 90 cents an hour	$0.945
Electric power	0.800
Backing off rivets	0.660
Total	$2.405

A typical installation for reclaiming cars using the arc process for rivet cutting is shown by Fig. 1. Platforms at a convenient height are provided along both sides of the cars so that the operators can readily reach all the rivets. The resistor through which each operator obtains his cutting current is mounted overhead on wheels on a monorail so that it can readily be moved along the length of the car by the operator. The cutting cable is supported by the resistor carriage which relieves the operator from dragging long cable leads over the floor. Four motor-generators operated in

parallel to deliver 1,000 amperes each, provide capacity for a total of eight cutters at one time, using from 400 to 600 amperes each.

The building illustrated is used exclusively for the work of cutting off the rivet heads. The cars are then removed to another building where the rivets are backed out by means of air guns, the old plates are removed and new plates riveted in position.

At another installation where cars are scrapped, some rivet heads are cut off but in addition sufficient cutting through the plates and angles is done, as shown in Fig. 2, in a building similar to that illustrated above, so that the cars can be switched under a crane way as shown in Fig. 3. The car sides are then knocked out by the crane operator, swinging a large skull cracker ball through the sides of the car. In a few minutes' time the car is reduced to the condition shown by Fig. 4 where a gang using a rivet gun is shown cutting the few remaining rivets necessary for the complete destruction of the car. Actual records at this plant show that ten men can cut up 36 cars per 22-hr. day. Individual records show that the various operators will cut from 1,800 to as high as 3,100 rivets 5/8 in. in diameter per 10-hr. day.

The time required to cut up a car depends entirely on the number of pieces into which the car is cut, or in other words the number of feet of cutting. In some instances as high as 240 ft. to 250 ft. of cutting is being done on 40-ft. coke cars, whereas by careful analysis this same car can be cut into

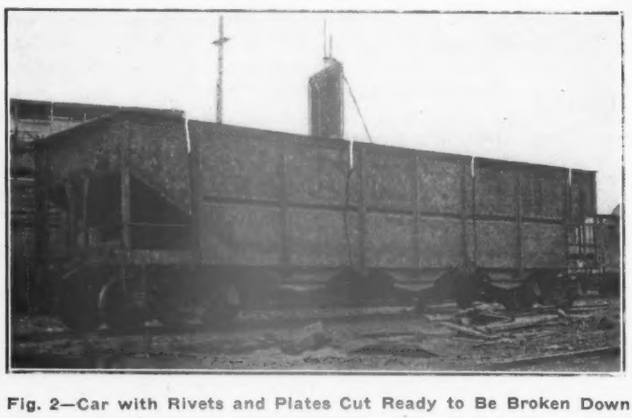


Fig. 2—Car with Rivets and Plates Cut Ready to Be Broken Down

14 pieces, involving 177 ft. of cutting, the pieces being sufficiently small to load in a car. This cutting can be executed by one operator in 3½ to 4 hours' time, the cost of labor and power not exceeding $6.75 to $7.00, based on labor at 60 cents an hour and power for the motor generator equipment at 2 cents a kilowatt-hour.

The size of the pieces into which a car must be cut is entirely dependent upon the material handling facilities of the company receiving the scrap. In some extreme cases, it will be found permissible to cut a car straight through from side to side, cutting it into three or four sections, the sides of which can be mashed over against the bottom where a crane is available to swing a skull cracker ball or an old truck.

One railroad has found that it is only necessary to cut hopper bottom cars at the corners and around the sides just above the bottom, leaving the sides, ends and bottoms full size, approximately as follows: Sides, 30 ft. 5 in. long by 9 ft. wide; bottom, 30 ft. 5 in. long by 9 ft. 6 in. wide; ends 9 ft. 6 in. long by 4 ft. wide. Gondola cars are cut at the corners and the sides and the bottom is cut across the center, making the sizes of the parts approximately as follows: Sides, 20 ft. long by 4 ft. wide; ends, 9 ft. 6 in. long by 4 ft. wide; bottoms, 20 ft. long by 9 ft. 6 in. wide.

When planning an electrical installation for rivet cutting or car scrapping work especial consideration must be given to the distribution system on account of the relatively high current values used and the relatively low generator voltage. Each cutting arc will be operated at 400 to as high as 800 amperes and the generator voltage will be approximately 60 volts. Where a number of cutters are employed the current to be handled will, therefore, run into several thousand amperes which will require the use of ample copper cable to keep the voltage drop within permissible limits—not to

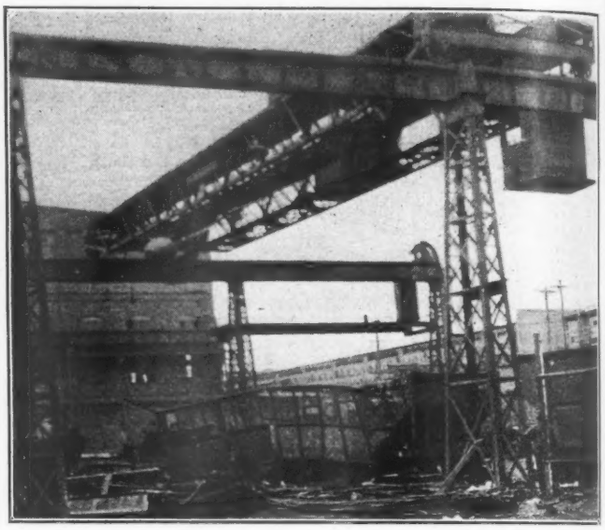


Fig. 3—Breaking Down the Car Body with a Skull Cracker

exceed 5 per cent of the generator voltage at the point where each arc is to be used. When the track is to be used as a part of the transmission system all joints must be heavily bonded. In some installations no special provisions are made for conducting the current from the car body to the rails but it is allowed to flow through the truck center bearings, journals and wheels to the track. This, however, in some cases at least, is not entirely satisfactory and results

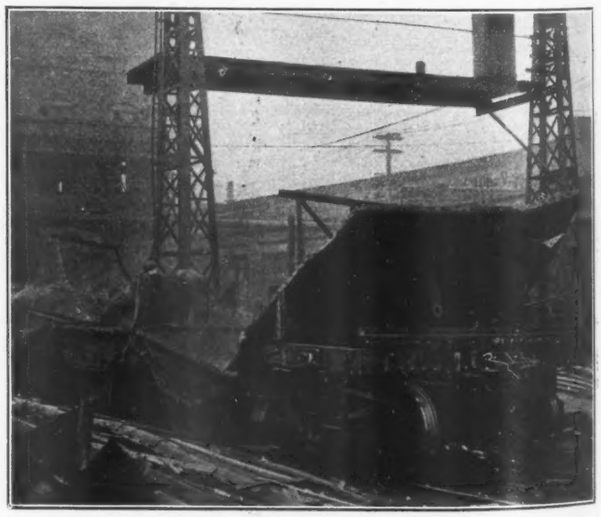


Fig. 4—Cutting the Few Remaining Rivets in the Hoppers with Pneumatic Hammers

in unnecessary loss as the voltage drop through the truck center bearings is considerably higher than at any other part of the car body.

To assist the operators in the cutting work it is advisable to have suitable scaffolding or platforms provided along the sides of the cars at a height of about 6½ ft. Each operator

will require a cutting resistor which will have considerable weight. Therefore, it is advisable to locate a number of these resistors on about 40 ft. centers under the platform so that they will be protected from the weather. A suitable terminal should be provided at the resistor so that each operator can readily connect his cutting holder cable to the resistor.

The motor-generator and switchboard equipment should be located in a building which will give the apparatus complete protection from the weather. This also centralizes the equipment so that it can be given the proper attention by a competent electrical attendant. It is usually advisable to install two or more motor-generators of say 1,000 amperes capacity each, to be operated in parallel when the current required is in excess of 1,000 amperes rather than one large machine, for several reasons. First, if one machine should fail, the plant can still be operated at a reduced capacity. Second, such a plant can be operated more efficiently because if the work for a given day demands only a portion of the available capacity, only a portion of the sets need be operated.

Recent Decisions of the Arbitration Committee

(The Arbitration Committee of the A.R.A. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will prrint abstracts of decisions as rendered.)

Superstructure of Car Telescoped

While the St. Louis Southwestern's train No. 760 was entering Valley Junction Yard, October 21, 1921, the engine broke loose from the train, which consisted of 86 cars, causing the brakes to apply in emergency. The sudden stop resulted in the breaking of eight longitudinal sills in C. & N. W. car No. 76822 and Pennsylvania car No. 70691. The sills of both cars were broken at the transom of the adjoining ends. The broken sills on the Pennsylvania car dropped sufficiently to allow the coupler to foul the tie. The continued movement caused the coupler to act as a lever which raised the car sufficiently to permit it to pass over the broken sills of the C. & N. W. car, which demolished the superstructure for a distance of approximately 10 ft. from the end. No repairs were necessary on the head car in this train, and none of the wheels left the rails when the accident occurred.

The St. Louis Southwestern requested disposition under Rule 120. However, the Chicago & North Western stated that it had received information from the Pennsylvania, whose car was also involved in the accident, which indicated that its car had been telescoped. It, therefore, requested counter billing authority to cover the cost of repairs, less the cost of improvements, according to Rule 32. However, the St. Louis Southwestern contended that the car had failed by reason of an emergency application of the air brakes, which, according to the rules, did not constitute unfair usage and was, therefore, the owner's responsibility.

The Arbitration Committee decided that telescoping of the superstructure of the car above the sills, due to the mounting of another car, constitutes unfair usage, for which the handling line is responsible. The contention of the car owner was sustained.—*Case No.* 1282, *Chicago & North Western vs. St. Louis Southwestern.*

Wrong Repairs Should Be Corrected Within Nine Months

On October 8, 1919, Chicago Car Interchange Bureau defect card No. A-285,199 was issued against the Chicago & North Western for one pair of cast iron wheels in place of wrought steel wheels, box four, B. & L. E. car No. 80,536. This car was first delivered home, after the issuing of this car, by the Pennsylvania on January 12, 1921. It was shopped for the correction of the wrong repairs and for other defects, and was then moved to Enterprise mine siding January 19, 1921, where it remained until January 3, 1922. The car was then moved to the Greenville, Pa., shops of the Bessemer & Lake Erie, where the wrong repairs were corrected, January 19, 1922. A bill was rendered in the January accounts of the B. & L. E. against the C. & N. W. for $122.40, in which neither the application of the wrong wheels to the car, nor any allowance for credit for service metal was recorded. The Chicago & Northwestern refused to pay the bill, contending that the wrong repairs must be corrected within nine months from the first receipt of the car on the home line. The Bessemer claimed that its bill was correct on the ground that the first paragraph of Rule 87 specifically exempted cases provided for in Rules 57 and 70, and that the delivering line was responsible under Rule 70 and should pay the cost of repairs, inasmuch as the bill had been rendered within two years from January 12, 1921.

The Arbitration Committee, in sustaining the claim of the C. & N. W., decided that the exception of Rule 70 as referred to in Rule 87 means that the railroad violating Rule 70 is responsible to the line to which it delivers the car and not responsible to the car owner exclusively, and that the case was clearly one of wrong repairs, which should have been corrected within nine months after the first receipt of the car on the home line to justify the bill on the defect card.—*Case No.* 1272, *Chicago & North Western vs. Bessemer & Lake Erie.*

Joint Evidence of Wrong Repairs Filed Too Late

On July 20, 1920, the Southern Pacific at San Jose, Cal., rendered a repair card, according to Rule 60, to cover the cost of testing and stenciling the cylinder and Westinghouse K-2 triple valve on A. T. & S. F. car No. 48047. The car arrived home on August 24, 1920. On January 22, 1921, the Santa Fe shopped this car at Los Angeles. Here the car was found to have an H-49 triple valve that bore the stencil "S.J.—7-20-20—S.P. Co.," instead of a K-2. A joint evidence certificate was executed by a joint inspector, and an inspector for the Santa Fe. On May 4, 1921, this certificate, supported by the San Jose repair card, was sent to the Southern Pacific with a request that it be furnished a defect card. In December, 1921, as provided by Rule 13, codes of 1920 and 1921, the Santa Fe rendered a bill to the Southern Pacific for $16.58 to cover the cost of restoring this car to standard. This bill was also supported by copies of the joint evidence certificate, the Southern Pacific repair card of July 20, 1920, and the Santa Fe repair card of January 22, 1921, showing that the wrong repairs had been corrected.

The Southern Pacific refused payment on the ground that its San Jose repair card showed that a K-2 triple was tested and stenciled and did not show the application of an H-49, and therefore, it was not responsible for wrong repairs.

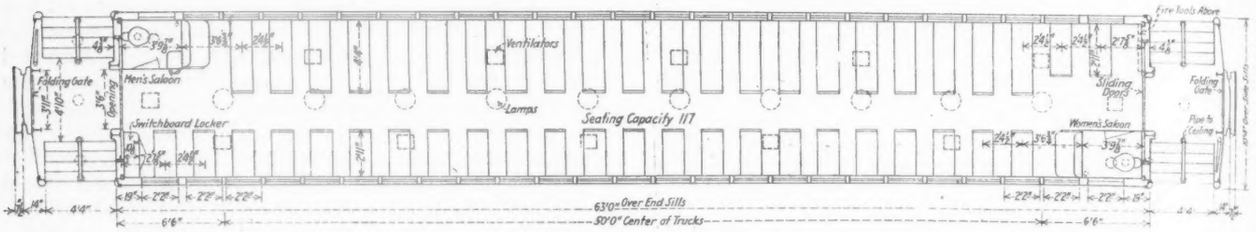
The Arbitration Committee decided that it is not evident that the Southern Pacific is responsible for the wrong triple valve in this case; and that if the wrong triple valve was in existence when the car was received home on August 24, 1920, joint evidence should have been obtained within three months, as required in Rule 12.—*Case No.* 1285, *Atchison, Topeka & Santa Fe vs. Southern Pacific.*

Steel Suburban Cars for Missouri Pacific

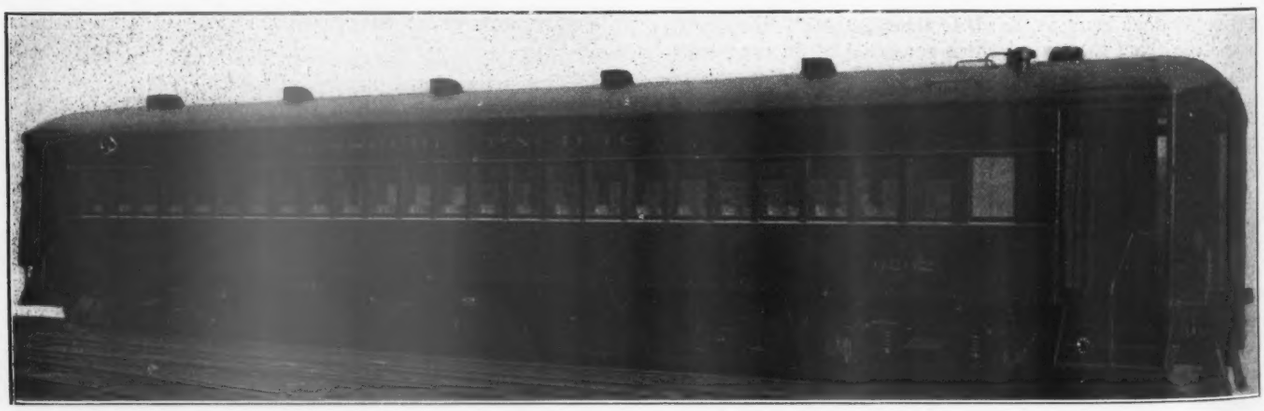
The Unique Seating Arrangement Provides for 117 Passengers with a Weight of 1,000 Lb. Each

THE Missouri Pacific has recently received 13 new suburban coaches and four combination suburban passenger and baggage cars from the American Car & Foundry Company. This equipment is intended for service between St. Louis and outlying suburban points.

The suburbs in the St. Louis district are only a few miles from the heart of the city, and it was decided that the utmost seating capacity with convenient facilities for promptly loading and unloading were demanded by the conditions. The seats, which are of the Walkover type, manufactured by the American Car & Foundry Company, are divided so that the long crossover seat holds three passengers and the short crossover seat has ample room for two passengers. The longer seats are 4 ft. 4 in. in length and the shorter ones 2 ft. 11 in. in length. The aisle, therefore, is off the center of the car. It affords ample space for passengers to move two abreast without undue interference. The seats have no arms, which adds considerable to the ease of passage through the aisle and of entrance into the seats.



Floor Plan of Missouri Pacific Suburban Coach Seating 117 Passengers



The Seating Arrangement on These Cars Provides a Long Crossover Seat for Three Pasengers and a Short Crossover Seat for Two Passengers

Cars Equal Through Passenger Coaches in Strength

• The cars are of steel construction throughout, with steel interior finish, except for Agasote headlining and wainscoting. The underframe and superstructure details have been so designed that their strength is equal to that of coaches in through passenger service.

The center sills consist of two 12-in., 35-lb. channels, having top and bottom covers of ⅜ in. open hearth steel plates riveted to the flanges. Cast steel double body bolsters and platforms make up the two ends of the underframe construction. The side sills are 6-in. by 6-in. by ½-in. rolled steel angles, extending in one piece from end sill to end sill. The side and center sills are tied together with two deep crossbearers, consisting of 5/16-in. pressings placed back to back and provided with top and bottom cover plates of 10-in. by ½-in. open hearth steel.

The floor supports, spaced approximately 2 ft. 4½ in. apart, form additional underframe members and consist of 3/16-in. pressed steel diaphragms. The side girder construction is made up of 3/16-in. rolled steel plates; it has for its lower chord a side sill angle of 6-in. by 6-in. by ½-in. section and utilizes as its upper chord the belt rail member, composed of a 4-in by ½-in. steel plate applied the full length of the car. On the inside of the side girder web are placed 2-in. by 2-in. by ¼-in. angles, which form an additional member of the top chord. The side posts are ⅛-in. channel-shape pressings, offset for the side sill and the side plate.

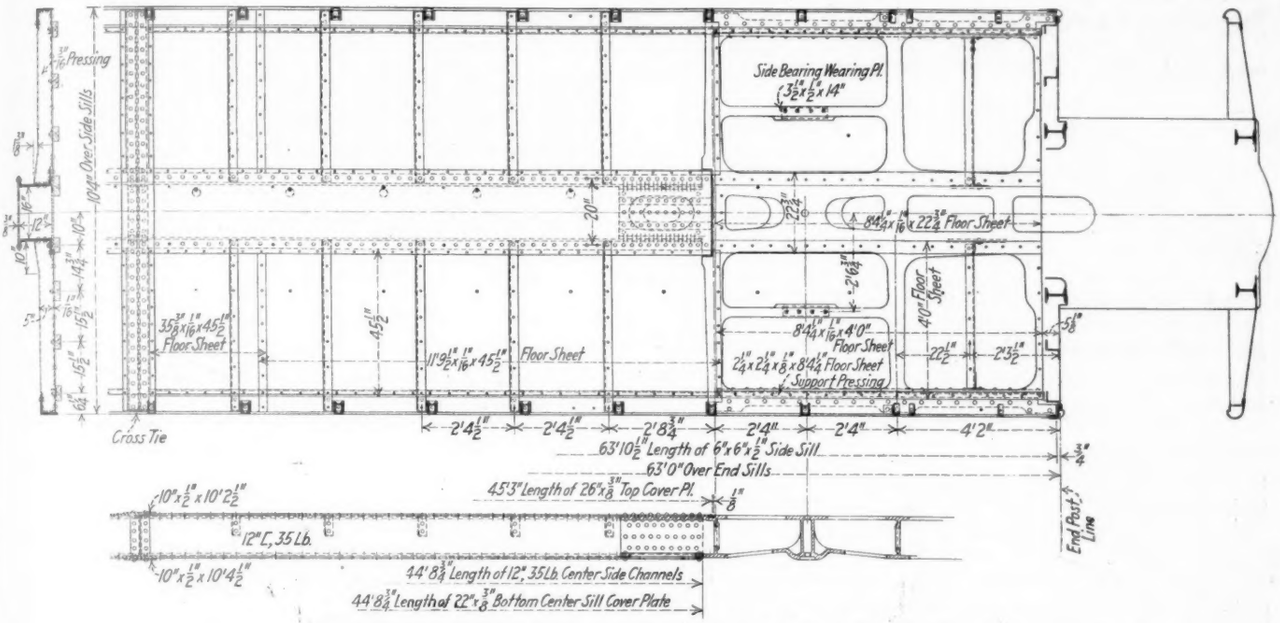
Turtle-Back Roof Applied

The roof is of the turtle-back type. It has side plates of 4-in. by 8.2-lb. Z-bars supporting open hearth steel angle carlines of 3½-in. by 2½-in. by ½-in. section. Two purlines, consisting of 2½-in. by 2-in. by 3/16-in. open hearth steel angles, are used in this roof construction. The roof is of poplar 13/16 in. thick by 3¼ in. face width, covered with canvas. Between the canvas and the wood roof is placed a felt roofing paper and as a preservative the underside of the canvas is given a coat of paint. The canvas is secured with copper tacks and the outside has three coats

of an approved outside canvas roof preserver. The roof is provided with 12 Utility honeycomb type ventilators, with registers on the interior.

Double windows are used in these cars with each outside sash fitted with O. M. Edwards window fixtures. Rex weather stripping is applied to four sides of the outside sash. A sash raised sufficient to secure a distance of 46 in. from the floor line to the bottom of the sash enables seated passengers to have an unobstructed field of vision. Seats are spaced so that each passenger is opposite a window, giving opportunity for ample light during the day.

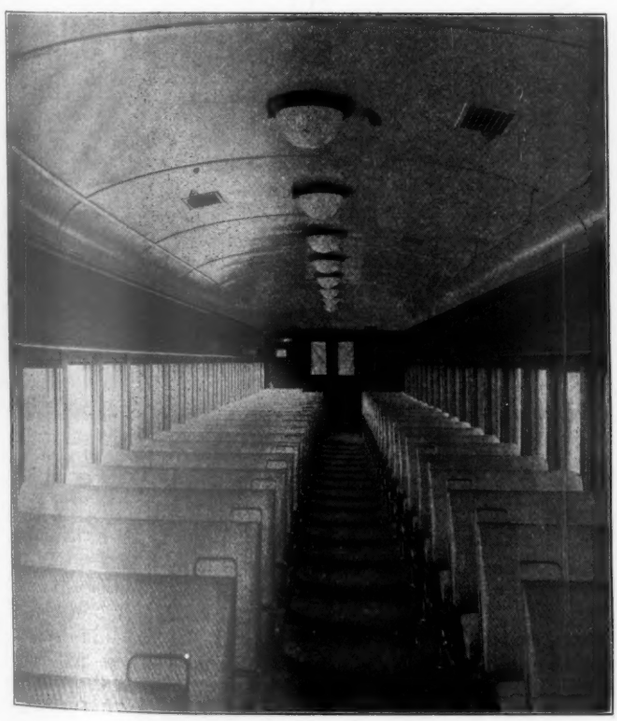
The cars are well insulated, having one course of 1-in. hair-felt and one course of 3-ply Salamander under the entire floor area. On the sides and ends against the outside sheets is placed one course of 3-ply Salamander, which is applied after the inside of the steel has received a coat of paint.


Side Bearing Wearing Pl.
Floor Sheet
Cross Tie
Length of 6"x6"x½" Side Sill
Over End Sills
Length of 26"x⅜" Top Cover Pl.
12" [, 35 Lb.
Length of 12", 35 Lb. Center Side Channels
Length of 22"x⅜" Bottom Center Sill Cover Plate
End Post Line

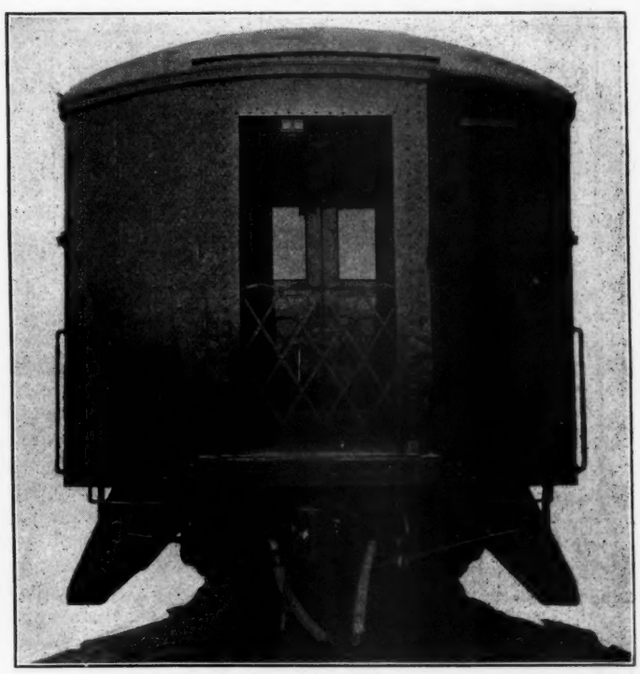
Underframe Construction of the Missouri Pacific Steel Suburban Cars

Careful Attention to Lighting Arrangement

To facilitate reading, the lighting arrangement for these cars has been carefully planned. Along the center of the low-arched ceiling are placed 10 attractive center lamps. The head-lining is finished in a cream color down to the frieze molding. This combination of a low-arched, light



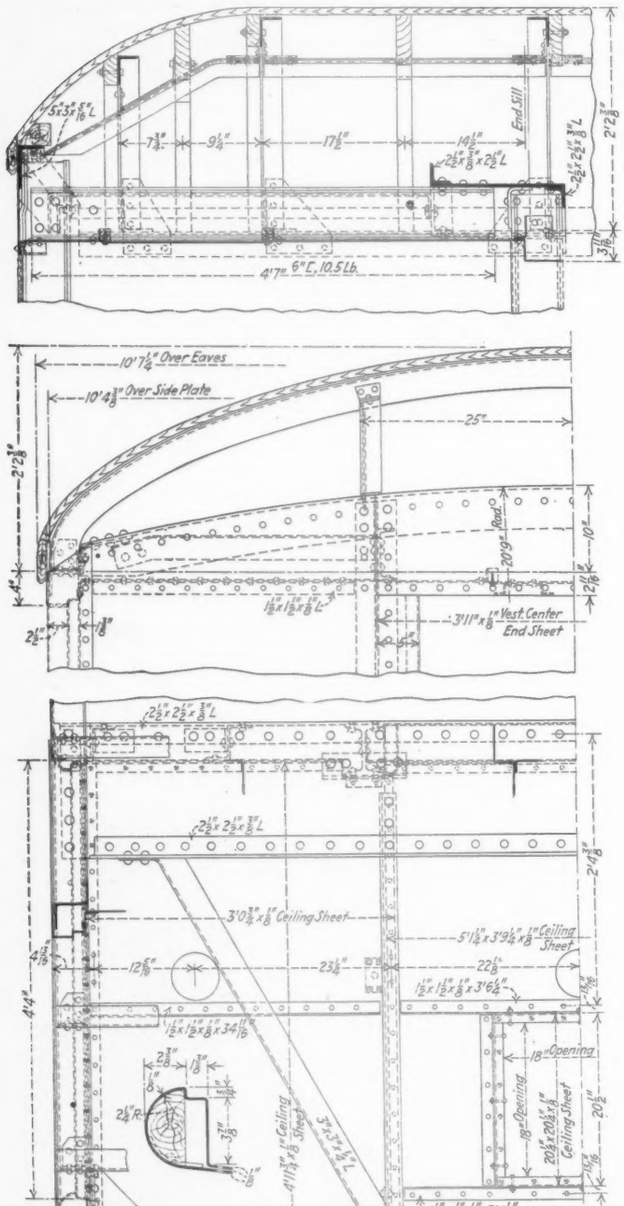
The Seats Accommodate Three Passengers on One Side and Two on the Other; Ample Light Is Provided for Reading



End View of the Car, Showing the Wide, Individually Operated End Doors

colored ceiling diffuses the light so that passengers can read comfortably. The extra wide platforms require well distributed light, and three vestibule lights are used on each platform. Current for the lamps is furnished by a 3-kw., 40-volt, 75 ampere generator, and each car is provided with an Edison 24-cell storage battery.

The latest system of vapor and pressure steam heat is used in the cars, designed to maintain at all times a com-


End Sill
41'7" 6"C, 10.5 Lb.
10'7¼" Over Eaves
10'4⅜" Over Side Plate
25"
20⅞" Roof
3'11" x ⅛" Vest. Center End Sheet
3'0⅜" x ⅛" Ceiling Sheet
5'1⅛" x 3'9¼" x ⅛" Ceiling Sheet
1⅝" x 1⅝" x ⅛" x 3'6¼"
18" Opening
20⅜" x 20⅜" x 1" Ceiling Sheet
18⅛"

Longitudinal (at the Top) and Cross Sections of the Vestibule Roof Construction and Plan of the Bulkhead

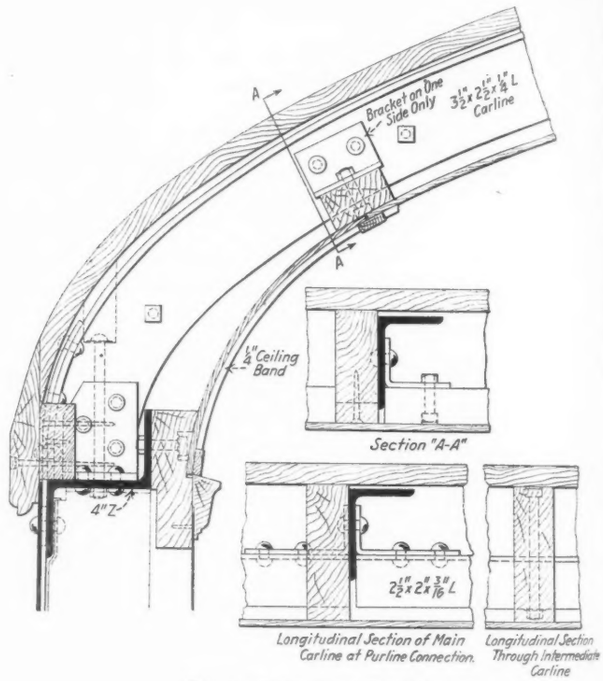
fortable temperature on the interior. Each car is provided with a Giessel sanitary water cooler of 11 gal. capacity. The water supply for the cars is taken care of by an overhead copper tank located at each saloon. The cars are equipped with the Westinghouse Schedule UC-1-1612 air brake equipment and the American Brake Company's slack adjuster.

Four-wheel trucks are used, with the Commonwealth Steel Company's frames, equipped with Simplex clasp brakes. The wheel base is 8 ft. long and the wheels are of cast steel, 36 in. in diameter. The journals are 5½ in. by 10. in.

Ample Room Provided for Entrance and Exit

The platforms are exceptionally wide, having an opening of 4 ft. 4 in. at the vestibule steps. A standing space of 25 sq. ft. is available. At the center of these steps a pipe railing is provided, which will allow of a continuous stream of passengers entering and discharging from the cars. In other words, the arrangement has been so worked out that persons getting off the car will not interfere with those entering the car. The vestibule steps have four treads.

It will be noted that this equipment and its appointments



Some of the Roof Details

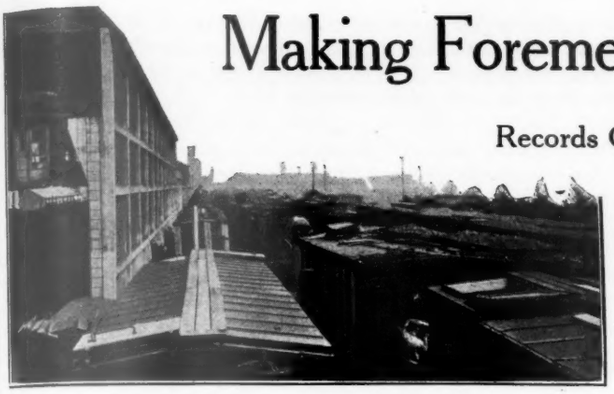
correspond with the highest grade of coaches used on through passenger trains. The interior presents an exceptionally neat appearance, and the low-arched roof gives the effect of spaciousness throughout the car. The interior is finished in mahogany color, and statuary bronze trimmings are used throughout. The exterior presents a smooth, uniform appearance, an effect which is secured by the wide letterboard and uniform window spacing.

All the doors in these cars are of steel construction. The end doors are double, of the sliding type, with stationary glass in each door. They are so arranged that each one may be operated independently.

The empty weight of these cars is 118,000 lb. With a seating capacity of 117 persons the weight per seated passenger is slightly over 1,000 lb. A modern steel coach for through train service weighs approximately 135,000 lb., and figuring a seating capacity of 88, the weight per seated passenger is approximately 1,500 lb. This car, therefore, is approximately 500 lb. less in weight per seated passenger than the ordinary coach.

The over all length of the cars coupled is 74 ft. 9 in.; the height from the rail to the top of the roof at the center is 13 ft. 6⅛ in.; the height from the rail to the side of the eave molding is 11 ft. 2 5/16 in.; and the height from the rail to the bottom of the side sill is 3 ft. 7 11/16 in.

These cars were built at the St. Charles, Mo., plant of the American Car & Foundry Company.



Making Foremen in the Car Department*

Records Can Be Kept of Each Man Considered Eligible for Promotion to Assure the Proper Selection of Competent Supervisors

By C. J. Nelson
Assistant Master Car Builder, C. & N. W., Chicago

THERE is nothing more important in connection with car department work than the selection of the right kind of men, so far as possible, for supervisory positions. Also, we are guilty of serious negligence and injustice to our superiors if we fail to do all within our power towards elevating only such men as can fully qualify for these positions.

Some railroads prepare men for supervisory positions by apprenticeships and special training methods, but other railroads, the great majority I believe, depend entirely upon selecting their supervisors from the ranks. With the latter method great care must be exercised in order to prevent giving preference to men who, by accident or otherwise, may be fortunate enough to gain special recognition for some extraordinary, meritorious act, fortunately timed to constitute what is sometimes called a "grandstand play." This may seriously mislead the man's superiors into making him a foreman when he lacks the qualities essential for the genuine leader and efficient supervisor.

Applications for Supervisory Positions

District, or division officers, general foremen and foremen are earnestly desirous of locating the most valuable supervisors for the companies they represent and to accomplish this purpose the following plan is offered for consideration: District or division officers should by circular letter, preferably posted on bulletin boards, inform all employees under their jurisdiction that they may make application to their respective general foreman or foreman, for supervisory positions. This letter should clearly specify what qualifications are required, and it can be so worded that employees who are not qualified and never can qualify, will readily understand their limitations and not file applications.

Questionnaires, covering all the information that may be desired from applicants, should be available in the general foreman's or foreman's office, and when an employee desires to file application for a supervisory position, the questionnaire should be turned over to him, and both questions and answers filled out on another sheet of paper in his own hand writing. In other words, the questionnaire should be used only as a guide in writing the letter of application. The general foreman or foreman to whom applications are made should then pass judgment on them and if for any reason an applicant is not desirable, he should be told exactly wherein his failings lie. Perhaps he has weak points that can be overcome, and if so these should be pointed out by his foreman, and the acceptance of the application deferred. If, however, the foreman decides that the applicant is satisfactory, the application should then be approved and forwarded to the district or division officer, together with a letter from the foreman giving a complete history of the applicant's record, qualifications, etc.

Before the application is approved by the foreman, however, he should know beyond any doubt that the applicant has not been guilty of attempting to mislead or misrepresent the facts in his application. He should be positive that the man has the qualifications necessary for a desirable leader.

The district or division officer to whom the application is sent should, by recheck, substantiate the information furnished and, if possible, become personally acquainted with applicant if he does not already know him. All fully approved applications should be kept on file in the district or division offices and some system maintained whereby division officers will at all times know exactly which applicant is in line for the next promotion. It would no doubt be advisable as a matter of encouragement to let the men know when they are in line for promotion, as this will have a tendency to spur them on to greater efforts and in all probability increase their value to the car department. In addition, these men should be assisted and given every opportunity to fit themselves more fully for whatever position of authority they will some day be called on to fill.

No other class of railroad work is any harder to master than that of car building or repairing, with its wide scope, many exacting details, and problems due to rapid change and development in the details of car design. It is practically impossible to secure car department supervisors with college educations and training, who at the same time have the necessary practical training. In fact, experience shows that a college education is not necessary to attain and retain some of the highest positions in the car department as well as other branches of railroad work. Certainly, however, it would be unwise to promote men to supervisory positions if they have not had a fairly good and well absorbed education.

Besides education, the men in line for foremen's positions should possess such additional assets as honesty, reliability, soberness, diplomacy, determination, enthusiasm and a feeling of loyalty toward their foreman and railroad. It is also important that they have a good understanding of men, and a pleasing personality. The quality of "broadness" was omitted from this list, through a desire to emphasize its importance. A leader who is lacking in this virtue and who is contaminated with the slightest degree of narrowness (always discernible to the scrutinous eyes of his subordinates) can never render his employer one hundred per cent service. His judgment of men will be distorted and his influence with them ended.

With this outline of the kind of men desirable for car department leadership kept in mind, I believe it would not be amiss for all of us who have already been entrusted with responsible positions to take stock of ourselves and ascertain how near we come to possessing all the qualities that we expect of those to whom we should be a shining example. Probably all of us will find opportunities for self-improvement. Similar thoughts have no doubt come to your minds

*Abstract of a paper presented at the February meeting of the Car Foremen's Association of Chicago.

in one way or another many times, but the subject of foremen selection is so very important that it can not too often be dwelt upon or discussed. If these words have had no other effect than being instrumental in starting just one good man towards the front line who would otherwise have been condemned to obscurity, I shall feel rewarded for my effort.

Qualifications of Car Inspectors

Next in importance to foremen, in my judgment, are the car inspectors and while they are perhaps ridiculed and criticized more than any other class of employees in the car department, or in fact on the railroad, yet I am sure you can conscientiously join me in paying respectful tribute to them as a whole, for the splendid work they perform under the most trying conditions. I doubt if we stop often enough to consider the numerous times they voluntarily risk their lives in order to protect their respective companies, its employees and the traveling public, nor do we appreciate as we should the many thousands of defects they discover as compared with the very few they overlook, which is evidenced by the small percentage of unit failures en route. The importance of selecting men for this exacting work cannot well be over emphasized as exceptional intelligence, loyalty and physical perfection are necessary for the proper performance of this class of work.

All car inspectors should be sufficiently well versed in the English language to enable them to understand and memorize all instructions issued to them, as well as the many rules with which they must be familiar; also, good penmanship is necessary in order to insure that the many important records and reports they are compelled to make in connection with their duties, be distinct and correct. In addition to this, they should have sufficient car repairing experience to have gained a thorough knowledge of car construction and anatomy which is essential for good judgment in handling the many problems requiring quick and sound decisions. It goes without saying that eye-sight and hearing must be perfect, also that their physical condition must be such that all duties can be properly performed regardless of weather conditions. It is during severe weather that the metal of an inspector is put to the test, and I would like to devote more space than permitted in this paper, in commending the loyal men, of whom I am glad to say there are many, who never flinch in the face of the severest kind of heat, cold or storm. It seems to me that the men who are doing this work faithfully, should have no hesitation in protesting against those who are not, knowing as they must the terrible consequences that might be the result of such shirking of duty.

In car inspection work there are more opportunities for the men assigned to it, who are so disposed, to shirk their duties without immediate detection, than in any other line of railroad work. It naturally follows, therefore, that we must depend almost entirely upon the honesty and loyalty of these men, and, knowing as previously stated that we have many such men engaged in this capacity, I feel safe in suggesting that a thorough analysis will reveal characters among them which can give an excellent account of themselves in higher positions of responsibility.

My appeal for your consideration of car inspectors is most sincere, being influenced to some extent probably by the fact that I personally served about ten years as a night inspector. I mention this not as a boast, yet with considerable satisfaction, for this severe schooling has been more helpful to me in the work I was subsequently assigned to, than any other experience I ever had.

Anticipating that this paper will be read by several hundreds of car inspectors, I wish at this time most earnestly to remind them of one of the most important things in connection with their work, of which I am sure they are fully aware but which is too often forgotten, and that is never to permit your mind to wander from your work while engaged in inspecting cars for safety. No matter how proficient a man may be, he can look directly at the most dangerous defect at times, and if his mind is not thoroughly concentrated on his work, may not notice the defect at all. I fully appreciate how difficult it is to keep the mind concentrated for several hours on one job in spite of the best intentions, and it is therefore urgently recommended that when one or more cars have been inspected with your thoughts elsewhere, you look them over again, if it can be done.

Gaging Wrought Steel Wheels for Car and Tender

Part II—Discussion

Discussion of Paper by Arthur Knapp on Use of New Steel Wheel Gage for Inspection and Billing

THE paper by Arthur Knapp, assistant to the consulting engineer, New York Central, which was presented at the December meeting of the Car Foremen's Association of Chicago, and given in the March issue of the *Railway Mechanical Engineer*, contained much valuable data on the use of the new A. R. A. steel wheel gage for determining defects, turning wheels and making out bills. An abstract of the discussion on this important paper is given herewith:

Mr. Mehan (C., M. & St. P.): For the purpose of having this matter made clear, we will say that this gage is placed on the wheel as explained. If short leg is not movable so that when the gage is put up against the side of the wheel in that way, and if the lowest point of the tread is over here it will throw your calculations out of order.

Mr. Knapp: That may be true, but in going over thousands of wheels it has been found that the wear is confined to one or two inches on the wheel tread. It is true that the tread and flange wear on a steel wheel would vary to a certain extent, but only one wheel, possibly, out of a thousand will wear away to any considerable extent outside the zone of application of the gage.

Mr. Mehan: Placing the finger against the worn flange it will indicate how much is to come off the tread in order to get in full flange contour. How do you indicate the service metal remaining where you don't turn tread and flange all the way and cut the witness groove into the flange? I am assuming that the witness groove is to be cut into the flange only in such cases as it is unnecessary to cut tread and flange to full A. R. A. contour.

Mr. Knapp: The calibration of the gage is on the safe side; that is, the calibration is based on the average form of tread wear. In the practical application to shop work we have instructed the N. Y. C. shops so that the operator will adjust his lathe to take a cut 1/16 in. less for the rough cut than the gage reads, and then depend on the finishing tool to produce the proper form of tread and flange contour. No two wheels wear exactly alike, and no gage can be designed that will cover every condition.

Mr. Mehan: When turning the witness groove in flange will it affect the contour of your tread?

Mr. Knapp: If the witness mark is larger than permitted under A. R. A. Rules you will have to take a second finishing cut to bring the contour to the proper form.

Mr. Mehan: Is it the intention to use this new gage in measuring service metal on steel tired wheels, and if so, just how is the gage to be used on such wheels?

Mr. Knapp: Because of different types of wheel centers the only way to control the rim thickness on steel tired wheels is to confine the measurements to the front rim face and base those measurements on the limit of wear groove, and in doing that we must use the gage as illustrated in Fig. 3 and read the graduations down to the limit of wear on the front face of the tire.

Mr. Petran (C., M. & St. P.): How does the N. Y. C. reconcile themselves to the rolled steel wheels when they place the gage on the back of the flange and take the measurements? The rolled steel wheel is not turned back and varies in thickness.

Mr. Knapp: That is the reason we have recommended that measurements be taken at two points.

Mr. Petran: Do they mark them with a chalk line?

Mr. Knapp: It is not necessary. The man who makes that measurement, if he is a lathe operator, can tell what should be done.

Mr. Petran: Don't you think there are lots of tires when if you look for the lowest point on the tread you will find the wheels out of center?

Mr. Knapp: There will be variation, but it does not necessarily mean that the wheels are out of center. The only way we can correct that particular feature will be when the wheels now in service are worn out. New wheels purchased under A. R. A. specifications have all these dimensions carefully guarded, as the new specifications specify that wheels must be round in the back within 1/8 in. and the difference between back and front must be within 1/4 in. in diameter. The front face must never exceed the back face in diameter.

Mr. Petran: We found in using A. R. A. gages that steel wheels seemed to be softer in spots and after running a certain period frequently the flange was out of true, yet the axle was true. The lathe operator will not always watch out for them, and as a result it will often vary 1/8 in. before turning and after turning. It is due to the man not finding the lowest spot on that wheel. In reclaiming wheels, we have a lot of ballast cars and work cars which remain on our road. All wheels condemned for passenger or freight service when given the last turning are put under these cars, and we find them four times superior to cast wheels, and when they are worn down they are scrapped.

Mr. Knapp: You find that the steel wheels that are worn down so they are condemned for passenger service will outwear four cast iron wheels in ballast car service?

Mr. Petran: Yes.

Mr. Knapp: Variation in rim thickness may be brought about by manufacturing practice. The flange thickness I am unable to account for. Flanges vary in thickness to a considerable extent. Sometimes I think that during boring the wheels are cocked a little in the boring mill.

Mr. Petran: We had that same condition. I would not want to blame the wheel. I believe the wheels originally were bored straight. I believe it was soft metal in the wheel that does it; some would have the flange egg shape. If it is not responsible for the egg shape neither is it responsible for the web and flange.

Mr. Mehan: At present we have been confined to a maximum of 1½ in. service metal in the rolled steel wheel. Do I understand that maximum has been increased, and if so, what is the new maximum?

Mr. Knapp: Steel wheels purchased under the former A. R. A. specification were subject to a tolerance in tape size of nine tapes over and five tapes under. That means that, for instance, a 33 in. freight wheel having a nominal tape size of 157 might vary up to tape size 166 or down to 152. With this variation the wheel rims were also permitted to vary in rim thickness to an extent of 3/16 in. under the specified thickness; namely, 2½ in. The specification required, however, that the average rim thickness per shipment must equal 2½ in. per wheel. Conditions of manufacture frequently resulted in the production of wheels of the same tape size with the rim of one wheel 3/16 in. under the specified thickness; while the mate wheel, i. e., a wheel with the same tape size, might have 3/16 in. in excess. It will be possible under this condition to mate wheels with a variation in rim thickness of 3/8 in. When removed from service, the condition of the wheel with the minimum rim thickness generally controlled the scrapping or re-application of the pair of wheels; and in this way the railroads were subjected to a considerable loss in service metal. With a 2½ in. rim we are able to use only 1½ in. in service, due to the specified condemning limit of 1 in. for passenger car and tender wheels. When that fact was considered by the committee, it was agreed that any tolerance affecting rim thickness should be worded to insure a full 2½ in. rim with any variation over rather than under. The new specifications require that any tolerance in tape size shall be over with none under, although the manufacturer has the same range for the variation usually experienced under manufacturing conditions. The change in this tolerance, with the requirements to insure a comparatively uniform interior diameter of rim, front and back, will tend to increase the amount of metal available in a wheel rim for service under passenger cars or tenders; and, of course, the change in condemning limits for wheels used in freight service will result in a further increase of service metal to the extent of 1/4 in.

Mr. Ripley (Chief Mechanical Engineer, A., T. & S. F., and chairman A. R. A. Wheel Committee): I want to express the appreciation of the Wheel Committee to you for taking up this subject. It is essential that you, who will actually use this gage, have a thorough understanding of its purpose and its functions. The difficulty in the proper measurement of steel wheels and billing for defects in same is one that has been recognized for years. The Arbitration Committee has had many cases brought before it, in regard to questions arising over billing, and the Wheel Committee was requested to attempt to remedy this condition. A great deal of time was expended in the study of this subject and in the development of the gage recommended. Mr. Knapp spent a great deal of time in studying the contours of worn steel wheels on the N. Y. C., and the credit for the final calibration of the gage belongs largely to him; though I may say that before deciding on the calibration, the committee secured figures from a number of roads located in different sections, in order to arrive at a fair average. The committee admits that it is possible to find occasional wheels with freak wear conditions on which the reading of the movable finger will be slightly incorrect. The maximum inaccuracy, however, will probably lie within 1/16 in., and these freak wheels will be few. In interchange the number of such wheels will probably be fairly well balanced. It is possible to make a gage which would measure all such freak wheels, but it would be so complicated that it would be impractical. The committee felt that the gage must be simple and one which could readily be understood. I believe you will all agree that the past practice of billing for metal in steel wheels has been unsatisfactory, and has not resulted in fair billing between roads. Theoretically, the only way we could make up a bill under the old rules, was to hold the bill until the wheel had been turned, and measurements taken both before and after turning. In actual practice it is almost impossible to keep track of all these wheels until

they reach the wheel lathe and records returned for billing. As a result bills have been made up largely on the basis of guess work. The committee hopes that this new tool will provide a simple method of making the bills on the repair track, just as bills for other materials are made. Before recommending this gage, the committee tried it out on a number of roads and all reports were favorable. However, they realize that in anything as radically new there are possibilities of certain weaknesses.

There is one question in connection with the use of this gage to which I call attention, as I fear there is a possibility of confusion arising. As Mr. Knapp stated, when measuring the thickness of metal in the tread of the wheel, the reading is taken on the vertical leg at the intersection of the underside of the back rim. Under the new specifications, this intersection will be a sharp line. However, on a number of older wheels you will find a rounded corner at this point. One manufacturer has taken a light cut to eliminate the sharp corner. When taking readings with this gage, it should be remembered that the proper point for reading is the theoretical intersection of the back face of the rim and the slope of the underside of the back rim. Therefore, if the corner is rounded inspectors should either sight the intersection of the slope with the leg of the gage or determine it by laying a straight edge or even his finger on this sloping underside of the rim.

While the committee has presented this gage as the standard for use in the Code of Rules, wording has been added in the Code to permit of the use of any other approved type. By approved gage, we mean one that has passed the approval of the Wheel Committee. They will be glad to consider any other type presented to them. They will insist, however, that it take all readings, in the same general manner as the A. R. A. standard gage, and that the calibration of the moving finger must be the same. This is absolutely essential if fair billing is to be maintained. One other such gage has already been approved.

This gage may also be used for flange height measurement by swinging the finger through an arc of 180 deg. and letting the back of this finger rest on the top of the flange. You can then place marks on the main body of the gage, indicating the intersection of the zero mark on the finger for the various heights of flange. The committee could not include this, because flange height requirements vary on different roads, but the gage has been so designed that the back of the moving finger will always rest on the apex of the flange, when in the reverse position to which I have just referred.

In addition to the use of this gage for condemning wheels and billing the use in shops is of vital importance. Mr. Knapp has called your attention to the great value of the metal in the tread of a rolled steel wheel. Few lathe men appreciate how much 1/16 in. metal is worth. In turning wheels they often take off entirely too much metal. Taking an extra cut usually results in their being called by the foreman for a waste of time, and they naturally take a sufficient cut to be sure and develop a full tread contour. The gage should put a stop to this wastage of metal, as the lathe operator can determine, before he takes his cut, exactly how much should be taken off to get the proper contour.

Mr. Lickey (N. Y. C.): I believe most turning flanges out of true is caused by wheel lathe drivers, perhaps two drivers on a side are the only ones doing the driving, thereby springing the axle.

Mr. Knapp: I would like to ask Mr. Lickey if they use a centering device at the lathe? I am anxious to hear wheel lathe operators talk about variation in flange thickness as it is hard to identify the point where that occurs. Some say it is warping of the wheels when purchased. All wheels are supposed to be examined with a plain gage, and I believe warping, even 1/16 in. can be detected. This, in my opinion, does not account for the variation in those wheels.

Mr. Radway (C., M. & St. P.): I have a wheel lathe in which the journals are held central by clips in the spindle, after which the chuck jaws come in contact with the wheel all at the same time and with equal pressure.

I often find as much as 3/8 in. difference between one side of the wheel and the other and in checking the outside contour against the hub contour and the bore, I find that there is a variation, showing that while the wheel was bored square with the flange, still the outside contour would not be concentric with the bore.

I understood the reader to say that they allowed 1/16 in. or on a reading of 5/16 in. they would remove 1/4 in. of metal. That would mean that the roughing tool would leave a witness mark 1/16 in. deep, this 1/16 in. of metal to be removed by the finishing tool. I do not find this possible as our finishing tools slide over the hard glazed surface and will not stand up.

Mr. Knapp: We can do that. What kind of steel do you use in your cutting tools?

Mr. Radway: We use Rex double A high speed, but possibly Rex triple A might do the business.

Mr. Knapp: The statement is made that you cannot take 1/16 in. of metal off the wheel, using a roughing cut and a finishing cut. Some of our lathes are able to remove 1/16 in. or better with the finishing tools, while difficulty is experienced with other lathes. Should it develop that 1/16 in. is an excessive cut for the finishing tools, the wheel should be permitted to revolve for two or three revolutions if necessary to enable the operator to finish the treads and flanges properly. The slight increase in the cost of turning under that practice would be more than offset by the amount of metal saved and the better finish on the wheel tread and flange.

Mr. Kleist (B. & O.): I would like to ask if the table which the N. & W. has gotten up could be used in connection with this gage?

Mr. Knapp: Yes.

Mr. Davis: (Universal Packing & Service Company): The taping table is copyrighted by Bernard Cook of the N. & W., but he has turned the whole subject over to me. I would be glad to give copies to anyone interested.

Mr. Kleist: As I understand it, this new gage does not necessarily supercede the old gages in gaging flanges, etc., in interchange. The old gage can still be used on flanges to determine vertical or worn flanges.

Mr. Knapp: Most assuredly. I believe the man inspecting cast iron wheels will be called upon to use the old gage. The object of this gage is to determine how much must be turned off on account slid flat or worn flanges on steel wheels.

Mr. Kleist: Is it intended that this new gage be used generally by the inspector in the yard and at interchange points?

Mr. Knapp: It must be used by the inspector in sending cars with defective steel wheels to the repair tracks. They must use it also for gaging flat spots, or chipped rims and such defects. We have tried to design it so that it would not be necessary to carry two gages, but I do not know how you can get around this question of sharp flanges so far as cast iron wheels are concerned.

Mr. Erickson: As I understand it, this gage is to be used on repair tracks to determine the amount of metal to be turned off to secure proper flange and tread contour and furnish the necessary information to the billing clerks without holding the bill up until the wheel had been turned, but that it was not necessary for the inspector in the train yard to carry it as he would be able to determine whether or not the wheel was safe to be in service by the use of the old wheel gage for determining flange thickness.

Mr. Ripley: How can you determine whether it is neces-

sary to cut the car out for defective wheel if you do not carry the gage?

Mr. Knapp: They could use the former M. C. B. gage.

Mr. Ripley: The past practice in condemning wheels for thin tread has been questionable. Inspectors have no actual way of determining the tread thickness. It is true, there has been a limit of wear groove on the rim, but as a rule the tread is worn somewhat hollow. It is impossible to determine just how close to the limit of wear line the center portion of the tread actually is. They could use a scale on the outside edge, but this makes no allowance for the hollowness. The real danger point, so far as tread thickness is concerned, is through the throat to the underside of the rim on the back. There is no way of measuring this except with some such gage as proposed. It is therefore necessary that all inspectors carry the A. R. A. steel wheel gage or an approved equivalent, otherwise, they will not be in position to condemn or pass steel wheels, so far as thin rims are concerned. It should be remembered that wheels made under the new specifications will have no limit of wear line on the front side of the rim.

As regards the other features of the gage, such as the notches for measuring slid flats, chipped rims, and vertical flanges, etc. The committee merely added these to make the gage more useful for inspection. The old wheel defect gage is still the standard in the Code, but we felt that at times the inspector would only have the one wheel gage with him, and these additional features would make it particularly useful. It would take care of everything which the wheel defect gage takes care of, except the thin flanges on cast iron wheels. The back of a flange on a cast iron wheel is rounded, and therefore the leg of the gage cannot be set squarely against it, though, of course, it is possible to get an approximate measurement of the flange thickness.

Ventilation and Heating of Passenger Cars*

Part II—Heating

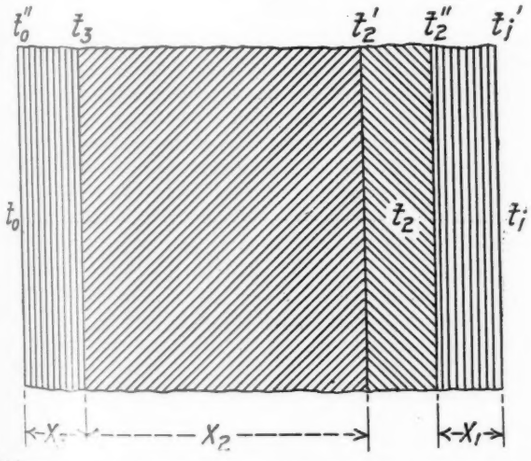
Analysis of Losses Through Enclosing Surfaces of a Typical Coach—Coal Used in Severe Weather

By K. F. Nystrom

Engineer of Design, Chicago, Milwaukee & St. Paul

GENERALLY speaking, there are only two modern heating systems in use in passenger trains at the present time on the American continent: the hot water system and the vapor system.

The hot water system, which is a self-contained unit in each car, is almost exclusively used as an emergency or auxiliary item. This system has not proved satisfactory. It is costly to install, requires constant attention, is dirty, and easily put out of order in cold weather because the water



Sketch Illustrating Heat Transmission Through a Wall of Several Materials

freezes in the drums or in the pipes. It is also difficult to control. Moreover, it adds from 2,800 lb. to 3,500 lb. to the weight of the car. It is a necessity, however, for some equipment, such, for instance, private cars which may be stored at small stations where steam is not available.

The vapor system seems to give general satisfaction. Its basic principle is embodied in the reduction of the live steam furnished from the engine through the train line to atmospheric pressure at 212 deg. F. by passing through a vapor regulator located underneath the car. With this system there are no heating pipes within the car containing steam at a pressure higher than that of the atmosphere. The danger of scalding passengers from broken pipes is, therefore, eliminated.

Steam at atmospheric pressure always registers 212 deg. F., therefore with the vapor system the heating pipes in all the cars are at the same temperature, regardless of the pressure in the train line, which naturally varies from the front to the rear of the train.

The outside temperature in the winter months in Canada and the northern part of the United States occasionally drops down to 50 deg., or more, below zero. It seems, therefore, that when figuring insulation for passenger cars, a temperature of not less than 30 deg. F. below zero should be considered.

The inside temperature in a passenger car may be taken at 70 deg. F., and with the outside at 30 deg. F. below zero a difference of 100 deg. F. will exist between the inside and outside temperature of the car.

Heat Losses in a Passenger Car

The heat losses from the inside of a passenger car are caused by (1) conduction or direct contact, (2) convection by air currents and (3) radiation, as from the sun. Air currents within a wall, commonly known as dead air spaces, convey heat by convection only when the spaces are tight.

The loss of heat through walls is both in the nature of radiation and conduction. The principal loss is found to depend on the difference of temperature and is similar to conduction rather than radiation which depends on a higher power of difference in temperatures. The general form in which this heat loss is given is:

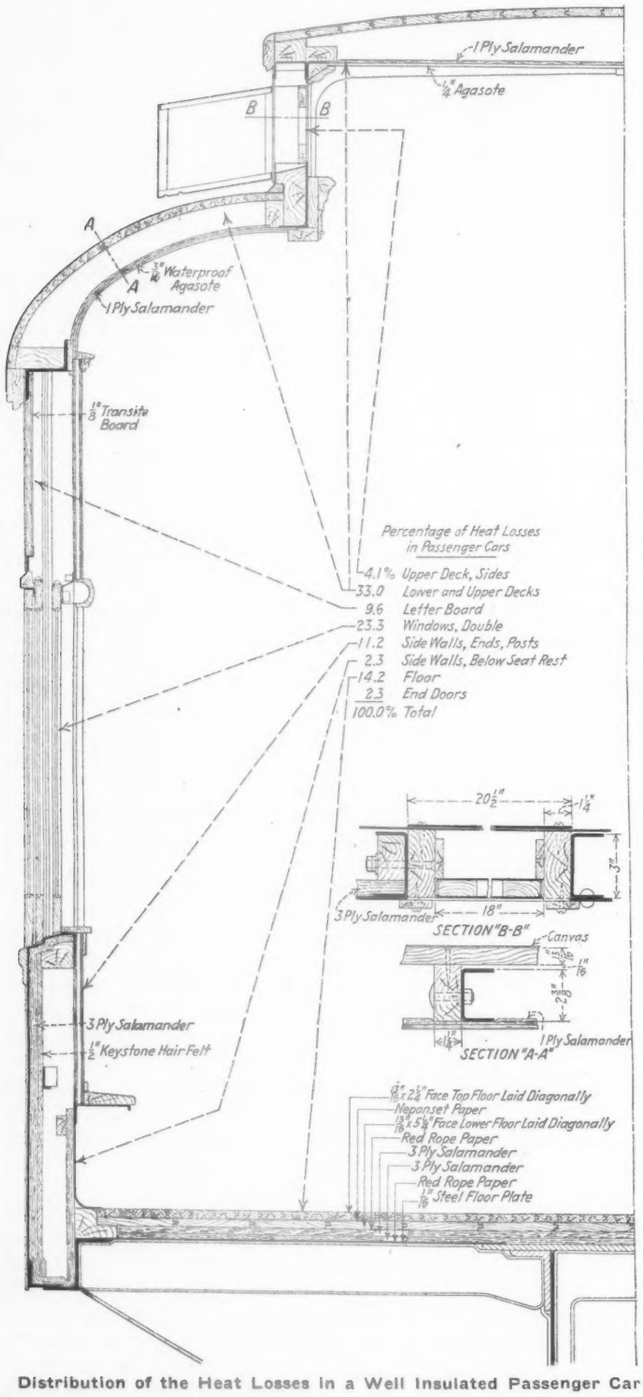
$$B = HA(t_i - t_o)$$

where A = area in square feet; H = heat transmitted per

*Abstract of a paper presented at the meeting of the Canadian Railway Club, held at Montreal, Que., February 12, 1924.

sq. ft. per hour per degree difference of temperature, in B. t. u.; t_1 = room temperature in deg. F.; t_o = outside temperature in deg. F.; B = B. t. u. transmitted per hour. The value of H depends on several factors: the surface, thickness, and kind of material, air spaces and condition of air at surfaces.

The rate of transmission of heat through any substance depends on the thickness and on the difference of temperature. If, for instance, the wall, as shown in the accompanying drawing, is made up of several thicknesses and the temperatures as indicated, the equations for the transmission of heat through each section must each give the quantity of heat transmitted by the wall, and these, therefore, must be equal to each other.



Distribution of the Heat Losses in a Well Insulated Passenger Car

The amount of heat conducted by any material per square foot of cross-section varies directly with the temperature difference and inversely with the thickness. This gives

$$B = \frac{C}{x}(t_1 - t_2) \quad \ldots\ldots (2)$$

where C is the coefficient of conductivity in B. t. u. per 24 hrs. for one inch thickness per square foot per degree, x is the thickness in inches and $t_1 - t_2$ is the difference of temperature. Using this for the wall shown in the sketch, it follows that

$$B = \frac{C_1}{x_1}(ti' - t_2'') = \frac{C_2}{x_2}(t_2' - t_3) = \frac{C_3}{x_3}(t_3 - to'') \quad \ldots\ldots (3)$$

At the surface of any material there is to be found a temperature different from that of the space around, and it is this difference which determines the flow of heat at the surface. If K is the coefficient of transmission, sometimes referred to as surface resistance, per square foot per hour per degree across the surface this becomes at different surfaces:

$$B = K_1(ti - ti') = K_2t_2'' - t_2) = K_3(t_2 - t_2') = K_4(to'' - to) \ldots (4)$$

The values of B in the sets above are all the same, hence solving for temperature differences and adding, the following results:

$$B\left[\frac{1}{K_1} + \frac{x_1}{C_1} + \frac{1}{K_2} + \frac{1}{K_3} + \frac{x_2}{C_2} + \frac{x_3}{C_3} + \frac{1}{K_4}\right] = ti - to \quad \ldots\ldots (5)$$

$$H = \frac{B}{ti - to} \quad \text{See formula (2)} \quad \ldots\ldots (6)$$

$$H = \frac{1}{\frac{1}{K_1} + \frac{1}{K_2} + \frac{1}{K_3} + \frac{1}{K_4} + \frac{x_1}{C_1} + \frac{x_2}{C_2} + \frac{x_3}{C_3}} \quad \ldots\ldots (7)$$

There seems to be no reliable data as to the actual combined coefficient of radiation and convection or the surface resistance designated K_1, K_2, K_3, etc.

The values for K at the inside of a wall varies from that on the outside. From tests made by L. C. Lichtz at the University of Illinois in 1915, it was found that the average value for K_1, the inside wall surface, for various material was 1.34. The values for K_o, the outside wall surface, is generally taken to be 3 K_1, or 4.02. The average K_1 and K_o is equal to K, or 2.63. In the following calculation, the value for the surface resistance has been taken as $K = 2$.

Due to the difficulty experienced in maintaining a perfect dead air space in cars, some engineers entirely ignore the air spaces in their calculations, but this practice does not seem to give true results where a number of narrow air spaces are provided. It is, therefore, considered fair in making a comparison of the insulation values for different types of cars to assign a value to each air space. Each air space will be considered as having two exposed surfaces and for convenience given the same value.

The conduction of heat or the thermal conductivity of various substances have been rather definitely ascertained by a number of tests. These are published by the National Bureau of Standards.

Heat Requirements for Passenger Cars

The required heat to keep the interior of the car comfortable depends upon the construction. One of the drawings is a cross section of a recently built car, and is a good example of a modern passenger car construction. It is necessary to point out that the design selected for analysis is better insulated than the average passenger car built. The length of car will be assumed to be 72 ft. inside.

The value for $\frac{x}{C}$ for thin steel plates and paper is so small that it will be neglected in the following calculations, in which the thermal conductivity of the materials has been

reduced to an hourly basis. The heat loss through the floor may be determined in the following manner:

1½ in. Salamander insulation: $C = 6.5$; $\frac{x}{C} = \frac{3 \times 24}{2 \times 6.5}$ 5.54

1⅝ in. wood floors: $C = 23$; $\frac{x}{C} = \frac{13 \times 24}{8 \times 23}$ 1.69

Two surfaces: $K = 2$; $\frac{2 \times 1}{K} =$ 1.00

Total 8.23

$H = \frac{1}{8.23} =$ ..... 0.1215 B.t.u. per sq. ft. per hr.

For the entire floor the heat transmission per degree difference in temperature $= \frac{9.08 \times 72}{8.23} =$ ..... 79.44 B.t.u. per hour

[Analyzing the various surfaces and calculating the heat losses in B. t. u. per hour, in the same way, using the proper values for C as given by the Bureau of Standards, the author arrives at the results shown in the following table.—Editor.]

Heat Loss Through Transmission Per Degree Difference in Temperature

	B.t.u. per hr.	Per cent
Floor	79.44	14.2
Side walls, below seat rest	12.79	2.3
Side walls, ends, posts	62.35	11.2
Windows, double	130.00	23.3
Letter board	53.75	9.6
Lower and upper decks	184.00	33.0
Upper deck, sides	22.66	4.1
End doors	13.13	2.3
Total	558.12	100.0

To make allowance for train speed and imperfect insulation surrounding steel parts such as posts and other details, 20 per cent will be added to the 558 B. t. u., shown in the table, making a total of 670 B. t. u. per hour. Approximately this amount of heat will be lost for each degree the outside temperature is lower than that in the car. This heat, together with what is required to heat the incoming air for ventilation and the heat lost through the train line underneath the car, must be supplied to the car. From this amount of heat, however, can be deducted the heat produced by the occupants in the car.

The average adult throws off about 400 B. t. u. each hour. At 70 deg. F., one B. t. u. will raise the temperature of 55 cu. ft. of air one degree. The proper air supply for each adult is generally assumed to be 1,000 cu. ft. of air per hour. The heat supplied from the human body will, therefore, raise the temperature of 1,000 cu. ft. air 22 deg. F. At a temperature of 50 deg. F., one B. t. u. will raise the temperature of 53 cu. ft. of air one degree, and the heat from an adult will raise a 1,000 cu. ft. air 21.2 deg. F.

The above shows that if 70 deg. F. is considered a comfortable inside temperature, no outside heat would be required to heat the air supply in the car until the temperature drops below 50 deg. F., provided a correct amount of incoming air is maintained.

We will assume that the outside temperature is 30 deg. F. below zero and the inside temperature in the car is maintained at 70 deg. F, which is equal to a temperature difference of 100 deg. F. It has already been shown that an occupant will raise the temperature of a constant air supply of 1,000 cu. ft. per hour about 20 deg. F. The air taken into the car must therefore be artificially heated 80 deg. F. The mean temperature of this air is at 10 deg. F. above zero. At this temperature one B. t. u. will raise the temperature of 48.5 cu. ft. of air one degree.

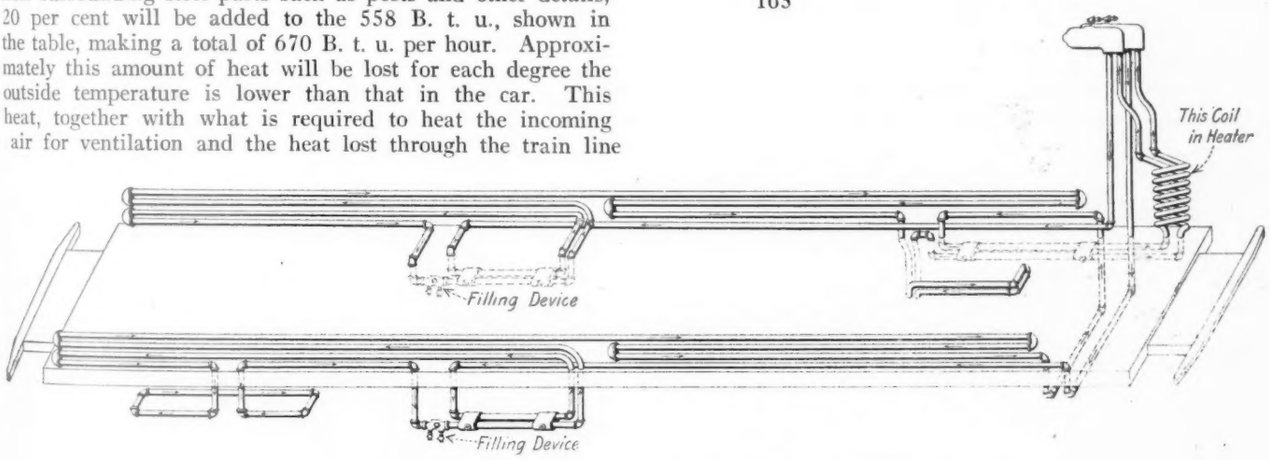
Assume that there are 50 passengers in the car, requiring 50,000 cu. ft. of air per hour. Then 82,500 B. t. u. per hour will be required to heat the incoming air. The heat required to keep the car at an inside temperature of 70 deg. F., against the heat losses will be $670 \times 100 = 67{,}000$ B. t. u. The average temperature of steam in train line is assumed to be 250 deg. F. and heat losses with a 75 per cent efficient pipe covering, 115 B. t. u. per lineal foot. The loss in the train line is $115 \times 100 = 11{,}500$ B. t. u. per car, or 0.34 boiler horsepower.

The total amount of heat for ventilation and heating is $82{,}500 + 67{,}000 = 149{,}500$ B. t. u. per hr. or 4.5 boiler horsepower, and the heat required per lineal foot of car is 2,076 B. t. u. per hr.

Radiation Surface and Fuel Required for Heating Cars

The usual size of pipes in a passenger car is 1½ in. The heat transmission per foot of 1½-in. pipe at a temperature of 212 deg. F. is about 165 B. t. u. per hour, at an inside temperature of 70 deg. F. The number of 1½-in. pipes required is

$$\frac{2076}{165} = 12.6 \text{ or } 6 \text{ pipes on each side.}$$



Piping Arrangement for a Hot Water Heating System

It would hardly be necessary to install this number of pipes in a passenger car, as in extremely cold weather the ventilator would be closed and the air supply reduced, producing the same condition as in dwellings in cold weather.

If the vapor system is used, which keeps the pipes at a temperature of 212 deg. F., the following amount of heat will be transmitted into the car.

760 × 165 = 125,500 B.t.u. or 3.75 boiler horsepower at 70 deg. inside temperature.
760 × 183 = 139,000 B.t.u. or 4.16 boiler horsepower at 60 deg. inside temperature.
760 × 200 = 152,000 B.t.u. or 4.54 boiler horsepower at 50 deg. inside temperature.

This will provide sufficient heat to keep the car comfortable in a temperature of 30 deg. F. It shows, however, that the heating system will be taxed to its capacity if doors and ventilators are not closely watched.

It requires .34 + 4.54 = 4.88 boiler horsepower to heat a car in extreme cold weather. In an average steam locomotive it will require 4 lb. of coal to produce one boiler horsepower, or it will take 4 × 4.88 = 20.0 lb. of coal per hour

to heat the car, or 480 lb. per day, or 1.7 tons per week. This is based on a temperature of 30 deg. F. below zero.

Some time ago tests were made at a terminal to ascertain the amount of water condensed in the heating system under certain conditions. A 70-ft. steel passenger coach was used in the test with windows, doors, and ventilators closed and the car at rest. The inside temperature was maintained at 88 deg. F., the outside temperature was 20 deg. F. above zero and the steam consumed as measured from the condensation was 106.5 lb. per hour. One boiler horsepower is equal to the evaporation of 34.5 lb. per hour from a temperature of 212 deg. F. to steam at atmospheric pressure. Hence the car required 3.1 boiler horsepower.

This car was equipped with five 1½-in. pipes on each side having a total length of 750 ft. The theoretical heat losses per lineal foot of 1½-in. pipe is approximately 140 B. t. u. at the given temperature, which would give by calculation 3.14 boiler horsepower. This proves that the actual condensation taking place in a passenger car closely corresponds to the theoretical radiation from the pipes. It may be of interest to mention that most of the coach yards in the northern part of this continent were originally provided with boiler capacity to furnish steam at a rate of three boiler horsepower per hour for the maximum number of cars stored.

It is reasonably certain that in extremely cold weather the average passenger car now in service will consume about four boiler horsepower per hour. A train consisting of 12 cars will then consume 48 boiler horsepower per hr., or 1,656 lb. of steam per hr. The steam capacity of a modern Pacific type passenger locomotive of a maximum tractive effort of about 40,000 lb. is approximately 46,800 lb. per hour. The cars will, therefore, consume 3.6 per cent of this amount in extremely cold weather, but as the boiler will not work at 100 per cent efficiency in cold weather, the actual percentage will be considerably higher.

Suggestions Pertaining to Car Heating

1—Heat losses through windows constitute 23.3 per cent of the total. We pay dearly for windows in passenger cars, when cleaning, breaking of glass and loss of heat are taken into consideration. In sleeping cars and parlor cars, where each passenger has ample room and light, would it not further economy and safety to reduce the number of windows?

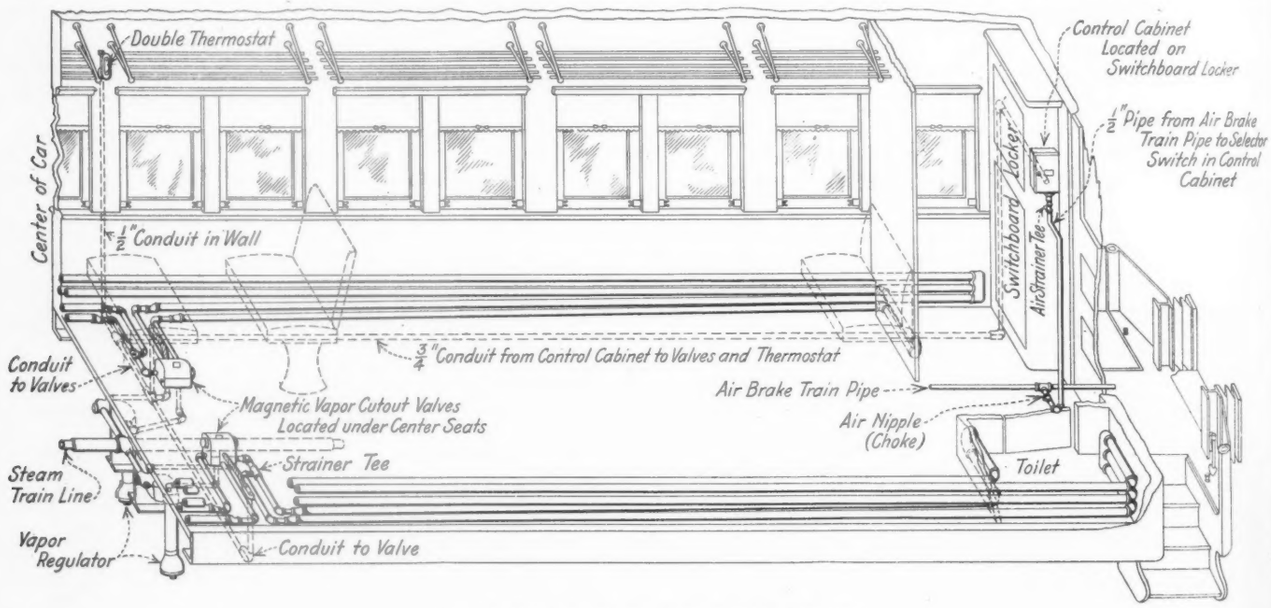
2—The area at letter board and lower and upper deck is not insulated in proportion to the balance of the car. The heat losses at these areas are 42.6 per cent of the total. Insulation can readily be improved at these points and considerable saving in fuel and increased comfort to passengers would result.

3—There is decided economy in using storm sash as the heat losses at windows are thereby reduced one-third.

4—It is a common practice to use 2-in. insulation in floors and walls and 2½-in. in ceiling of refrigerator cars, and it does not seem out of place, when the heat losses are seriously considered, to adopt this practice in passenger cars. The heat losses would thereby be reduced about one-half; the car would be cooler in summer and less noisy.

5—Insulation should be applied continuously the full length of the car in one piece in place of in a number of small pieces fitted between steel members. This could be accomplished by applying the insulation to the inside face of the steel members in the same manner as in steel frame refrigerator cars.

6—When passenger cars are in the coach yard for cleaning or storage it is not necessary to maintain a high temperature and the steam supply should be reduced. This can best and most economically be accomplished by automatic heat control.

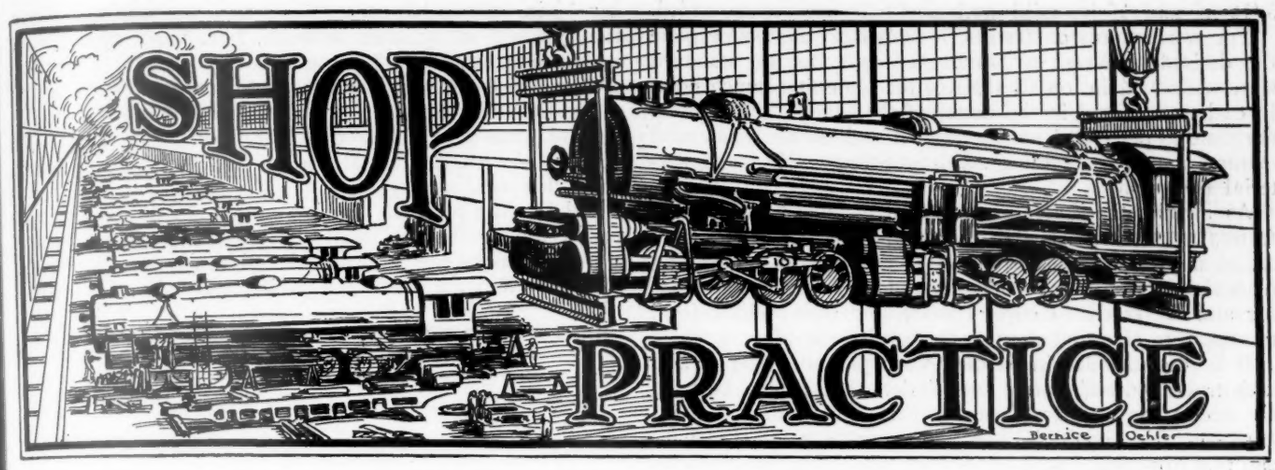

Double Thermostat
Control Cabinet Located on Switchboard Locker
½" Pipe from Air Brake Train Pipe to Selector Switch in Control Cabinet
Center of Car
½" Conduit in Wall
Switchboard Locker
Air Strainer Tee
¾" Conduit from Control Cabinet to Valves and Thermostat
Conduit to Valves
Air Brake Train Pipe
Magnetic Vapor Cutout Valves Located under Center Seats
Air Nipple (Choke)
Strainer Tee
Toilet
Steam Train Line
Vapor Regulator
Conduit to Valve

Installation of a Vapor Type Heating System

7—Heating pipes inside of the car should be installed with proper drainage and kept 2 in. from the floor, so the floor could be cleaned with a scrubbing brush or mop.

8—Steam pipes resting on the floor are subject to rapid corrosion and often have to be replaced, a considerable job as in most cases the seats have to be removed. Consideration should be given to the advisability of using iron or even brass piping for car heating, or having this piping protected by galvanizing or some other durable and non-corrosive coating. The disadvantage of galvanizing lies in the fact that it does not protect the threaded couplings which are the most vulnerable parts of this pipe system. A malleable lead plating would be preferable and less expensive than wrought or brass piping.

In the analysis of heating it has been shown that at the present time the average passenger car is not uniformly insulated when heat losses are considered. A close study of the problem will reveal that it is immaterial if the car is made of wood or of all steel, provided the proper amount of insulation is used.



Welding Standardization in Locomotive Shops*

Methods Used on Running Gear, Cylinders and Reclamation Work—the Proper Care of Equipment

By James S. Heaton
Welding Supervisor, Wabash, Decatur, Ill.

THE importance of making the proper preparation for a weld cannot be over-emphasized. A failure on the part of the operator to observe instructions, such as were outlined in the first part of this article, will result in unsatisfactory welds. The sand blast usually makes a thorough job of cleaning and its extensive use is recommended.

In repairing mud-ring corners that have deteriorated, the

Engine Cylinder Before Welding

edges of the sheet should be cut so that the mud-ring will show at least ¼ in. After this work is completed, the worn places should be cleaned with a sand blast. Weld along the mud-ring first, and then along the vertical seams, filling both seams to 45 deg.

When washout holes have been reamed beyond standard or have been worn away, countersink the hole and insert a bushing. Weld by filling the countersink and reinforce around the bushing. If the plate around the hole is deteriorated, insert a brass plug and weld around it. The plug can be removed very readily.

Patches may be welded on smokeboxes by either the butt weld or the lap weld method. Seams and edges of the butt straps should be welded, as this makes an air-tight job and a smokebox must be air tight.

Frames and Motion Work

There are many different parts that can be welded with safety and at less cost than they can be replaced or repaired by the old methods of patching and blacksmithing. However, care should be taken and experienced welders should be used on all operations. The building up and welding of spring equalizers, spring saddles, truck equalizers, spring seats, cylinder heads, tanks, oil drums, etc., can be readily accomplished if ordinary care is taken. Savings can also be effected in many other ways with welding.

In welding frames, see Fig. 2, approved procedure is to tram the frame and see that it checks with the opposite side, then tram over the break, locating points by which expansion will be governed, allowing ⅛ in. to 3/16 in. according to the size of the frame. Frames should be cut out with a double vee whenever possible, using the cutting torch to do the work. Clean the surface with a sand blast and apply a ⅜-in. plate for reinforcing on the bottom. This plate should extend ½ in. on each side of the frame to allow for the side reinforcing rods. Weld the plate solid to the frame, then when the frame is large enough, filler rods should be used. However, extreme care should be exercised to obtain a perfect union between the added metal and the filler rods. The use of the filler rods effects a very large saving in time and material. It has been proved that the quality of the weld is just as good as welds made without the rods, if proper care has been taken in doing the work. All frames should be reinforced on the sides and top by using ½-in. rods extending 1 in. on each side of the weld. Care must also be taken to weld solid between the rods. For this work

*This is the concluding installment of an article begun in last month's number, page 176.

3/16-in. and ¼-in. mild steel electrodes are recommended.

For worn places on frames, it is best to use boiler plate the desired thickness to bring the frame to the standard size. Allow ¼ in. on all sides of the plate and punch holes in each corner and in the center of the plate. Then clamp the plate in place and weld around it and fill the holes solid to the frame. By welding solid considerable time and material is saved.

As a rule, the fractures encountered in cast steel truck frames are located in the tension members. In order to secure a proper factor of safety at the joint, a reinforcing plate should be applied to the underside of the tension member and the fractured edges beveled and then welded from the opposite side and around the reinforcing plate.

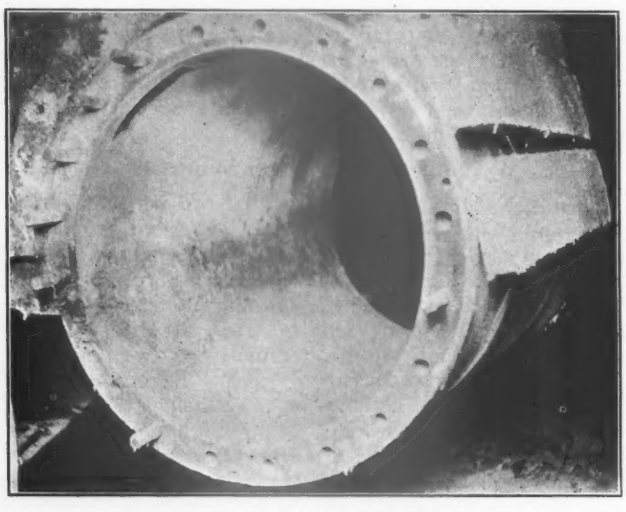
It is recommended in welding worn places on engine and tank truck pedestals, arms and binders that electric be used for steel parts and acetylene for cast iron parts. A mild steel electrode should be used when welding by electricity and cast iron rods should be used when welding by acetylene.

Holes in guide yokes, frame and bumper beams should be fitted with plugs, allowing ¼ in. on each end for welding. This makes a solid weld and eliminates a waste of time and material by having to weld the hole.

Cracks in deck castings and cross-ties should be beveled with a cutting torch to 45 deg. and cleaned off with the sand blast. Then place a screw jack between the frame to relieve the tension and weld by the electric method. Take out the jack when the weld is half finished.

When holes are worn or broken out in brake hangers, beams and binders, insert a carbon stick in the hole and weld around the stick. This eliminates the drilling out of a completely filled hole.

Worn places on the front end of main rods should be welded by the electric method. In reducing the size of the



Engine Cylinder After Welding

opening for the front brass, or welding on an oil cup the electric method should be also used.

When knuckle pin holes in side rods are to be reduced, use a round rod of the size required to reduce the hole. Shape it into a ring and insert it in the hole and weld by the electric method, taking care to weld solid at the bottom and make the rings square at the top. This method also reduces the amount of time and material as compared to that required in welding solid. This method should also be used for wrist pin holes.

When a connection hole is to be reduced, use bar iron of the size required to reduce the hole. Shape it into a ring, as in the previous job; insert it in the hole and weld by the electric process. The ring should be placed so that an opening ½ in. will be left on each side of it for welding. When the iron is 3 in. or more in width, 1-in. holes, spaced 3 in. apart, must be punched in the center.

When such parts as piston rods and shafts are worn beyond a fit, they can be built to standard by using the electric method, with a mild steel electrode. This will machine the same as the original metal and good threads can be turned from this welding.

All wearing parts of the link motion should also be built up by the electric method.

When guides are ⅛ in. under size, they can be welded solid. If they are more than ⅛ in. under size, a plate with

ENGINE NO.	DATE	RIGHT SIDE	LEFT SIDE	WELDED WITH	WELDED BY	ON ENGINE	REMARKS

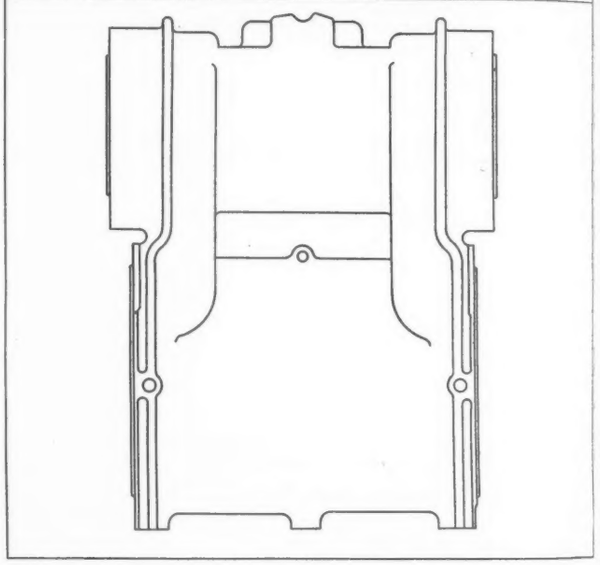


Fig. 3—Report That Is Used for Showing the Location of Welding Work Performed on the Side of a Cylinder

holes drilled in it 6 in. apart, should be clamped to the guide and the edges and holes welded solid. The electric method should also be used for this job.

Piston Heads, Crossheads and Valve Bushings

When piston heads are worn at the bottom side, they can be built up with Tobin bronze, applied by the acetylene process. It has been found that heads built up by this method wear better than the original metal.

When a crosshead is worn by the front end of the main rod, it should be welded solid. If the gib holes are worn they should also be welded solid. The electric method is recommended for this character of work.

Valve and cylinder bushings can be removed very easily with the carbon arc. The old method of chipping out with a hammer and chisel is a long and tiresome job.

Repairing Cracked Cylinders

In cylinder work, see Figs. 3 and 4, have the crack chipped out to 90 deg., leaving an opening at the bottom of ⅛ in. Have the cylinder lagged, except at the break and then place a charcoal pan under the cylinder and fill it with charcoal until it reaches well up on the sides of the cylinder. Heat to cherry red color and weld by using cast iron rods with a flux. If the break is very large, it is best to have two welders on the job so that the work can be finished after once starting. When the work is completed cover the cylinder completely with lagging and asbestos sheets and allow it to cool gradually over night.

If the cylinder has a thick wall and happens to be broken on the side, have the crack chipped out from the outside and apply studs staggered about two inches apart and weld by the electric method, first welding around the studs and then between them. Use mild steel electrodes and cast iron flux. By this method the cylinder does not have to be heated or bored.

Stoker Repair Work

For stoker conveyor and elevator screws, use round iron the desired thickness to bring the flukes to standard. Form the rod around the flukes and tack the weld at intervals of 8 in. Continue this method until the rod is formed over the worn place and then weld on each side of the rod, extending

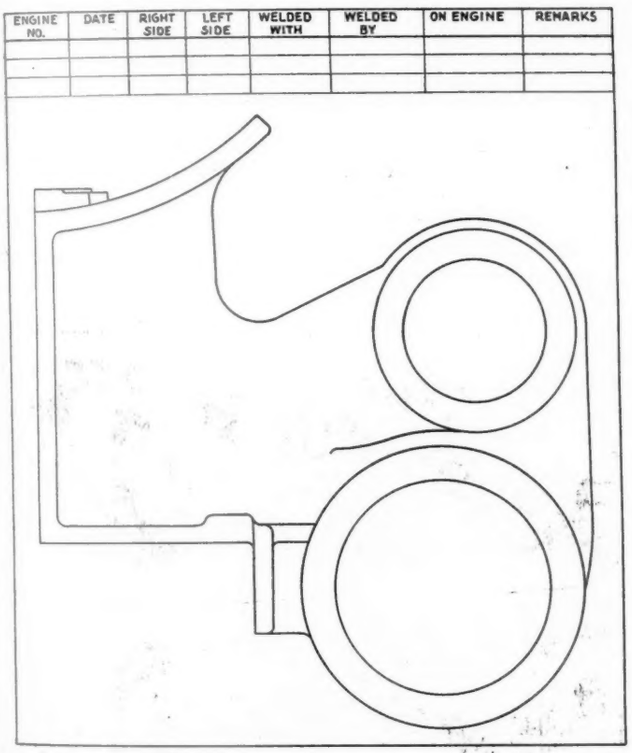


Fig. 4—Form to Report Welding Work Performed on the End of a Cylinder

down on the fluke one inch. Weld by the electric method and use a carbon steel electrode. Worn places on the drive shaft, elevator shaft and pawls can also be reclaimed by electric welding the worn places, using a mild steel electrode. Breaks in the elevator screw housing can be repaired by brazing by the acetylene process, using Tobin bronze with a brass flux.

Superheater Units

Cast steel or torpedo superheater unit ends must be cleaned off completely until good metal shows. Preheat to an orange red and slightly carbonize the flame while working inward. Use a little cast iron flux and allow to cool slowly. It is best to use Swedish iron for this work and be sure that all the water is removed before starting to weld. This procedure must also be followed when welding by the electric method, except the mild steel electrode should be used.

Rod Brasses and Driving Boxes

When welding rod brasses, preheat in the furnace until they become a very dark brown color, then remove and weld by using Tobin bronze and a brass flux. When finished, allow them to cool in the open air. When more than one brass is to be welded, place another brass in the furnace as soon as one is taken out. This will save time.

The following method should be used in reclaiming cast iron driving boxes. When cellar bolt holes are worn or the lugs are broken at the holes, preheat the cellar in the furnace to a dark red color. Prepare the necessary number of carbon cores of the required size, leaving the core long enough to prevent any metal from distorting the shape of the hole on the outside surface of the lug. Then place the core rod and puddle the metal around it from the top of the hole. Be sure to penetrate about half way through and build up even with the face of the lug, then turn the casting over and complete the work on the lug first started. Finish one at a time. After welding, allow the box to cool slowly. This method eliminates the boring out of solid material. If the lug is broken off, then weld solid. Use cast iron welding rods for both operations.

In welding shoes, wedges and hub liners on boxes, the liners should be beveled to 45 deg. on the edges and made ½ in. smaller all around. Holes should be punched or drilled in the center of the liners. Weld by first filling the holes and then around the edges of the liners. This eliminates the drilling and tapping for patch bolts. Care must be taken to weld solid through the holes to the box.

Broken Wheel Spokes and Tires

For broken wheel spokes, cut the rim next to the broken spoke. Bevel one end of the spoke at the back to 45 deg. on both sides and clean by using the sand blast. Then jack the rim out ⅛ in. and weld by the electric process. Weld

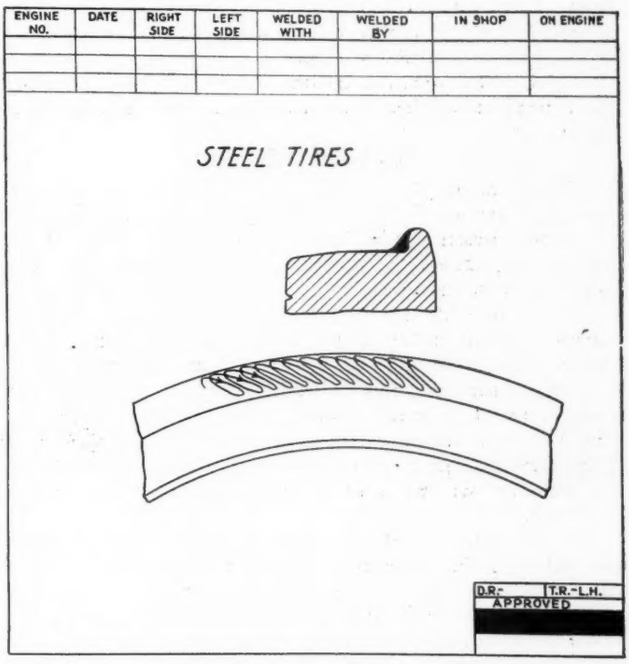


Fig. 5—Form for Reporting Welding Work on Steel Tires

one side, then remove the jack and finish the weld on the other side. The object in cutting the rim is to take care of any stresses that might be set up and eliminate the possibility of wearing a flat spot over the welded spoke.

Start welding tires on the front or back quarter and weld two feet, operating the arc back and forth across the flange. Then turn the wheel two feet and proceed in a like manner until the job is finished. The main object of this method is to keep the arc moving, thus preventing the flange from heating to any appreciable depth. If the tires are to be turned after welding, use a low amperage, if not, then use a

high amperage. A report, as shown in Fig. 5, should be made of all tire work.

Reclamation Work

For reclaiming axles, the standard sizes and limiting dimensions of A.R.A. axles for passenger, freight and tender trucks should be followed. Axles condemned for lateral wear occurring at the collar and shoulder of the journal can, in most cases, be returned to service if only the collar is built up and turned to standard dimensions. This can be done without heating or annealing.

The reclamation of couplers includes not only minor repairs, such as building up worn shanks, but also the welding of heads. All fractures should be cut out the full depth of the thickness of piece, cleaned off and welded, and have extra reinforcing wherever possible. A worn coupler should have a piece of boiler plate applied and then welded around it. Worn knuckles should be built up on all wearing points. A 6½-in. coupler butt may be converted into the new 9⅛ in. standard by welding on boiler plate shims to increase the dimensions.

Another item on which considerable savings have been effected is in the building up of chaffing irons and angle bars by electric welding. In the old days when they had become worn they found their way to the scrap pile.

Fractures in car bolsters should be cut out and prepared for welding in the same manner as explained for couplers. In addition, a reinforcing plate should be applied. When fractured bolsters are received that have previously been repaired by riveting on straps, the straps and rivets are removed and the fracture is welded. The rivet holes are then welded up and a reinforcing plate is welded on. This is extended over the zone within which the particular class of bolster has indicated a weakness.

In all of the jobs just outlined where the kind of electrode to be used has not been specified, a mild steel electrode should be used.

Acetylene Welding

Before starting to weld or cut, be sure that the regulators are in proper condition. Turn the screws to the right until the right pressure shows on the small gage. The large gage registers the amount of pressure in the drum and the small gage registers the pressure in the hose.

If any trouble is encountered with the equipment, the operator should not try to repair it himself, but should take it to the foreman or to the toolroom. The equipment is of a delicate nature and requires skill to repair it. Do not connect a hose to a drum without a gage. It is dangerous as the hose may burst and result in injury to the operator. Have only the pressure required on the small gages so that the pressure will not have to be controlled by the valve on the torch.

Do not start a weld that has not been cleaned properly and all possible allowance made for contraction. Do not cut plates that can be sheared and never use a tip that is too large. This will save gas and will make a neater job. When practicable, the gasoline or oil torch should be used for heating large surfaces. It is too expensive to use the welding torch for such jobs.

Torches

Care must be used in lighting and shutting off the torch. To light a torch, the acetylene must be turned on first and the gas ignited. Then open the oxygen valve and add oxygen until a bluish flame with a small bulb appears. This is a neutral flame and must be used at all times except when welding cast steel ends on superheater units. When a carbonizing flame is to be used, it can be obtained by using excess acetylene.

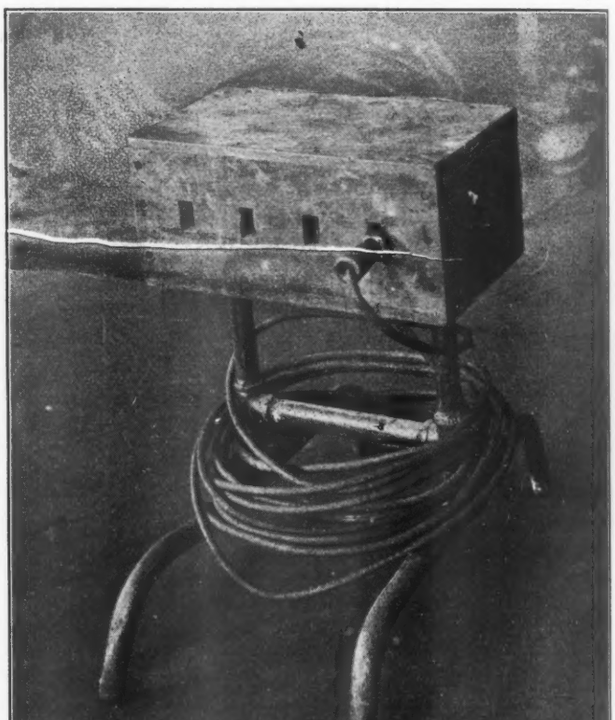
When the operation has been completed, the acetylene valve must be shut off first and then the oxygen valve. If the oxygen valve is closed first and the acetylene valve is leaking, the flame may cause a back-flash in the hose. Never shut off the oxygen valve first except in case of a back fire.

If a tip comes in contact with the molten metal, the holes will become clogged, thereby causing a torch to back fire. Loose heads and joints will also cause back fires in the welding torch. When a cutting torch back fires, the oxygen valve must be shut off first and then the acetylene valve. Then put the tip and the head of the torch in water to cool off. When a welding torch back fires, the oxygen valve must be shut off first and then the acetylene valve, then put the tip *only* in water until it is cooled, when the head may be immersed. When a cutting torch is leaking at the head from overheating, never tighten the tip nut until the head and tip have been cooled off completely, for by so doing the threads on the head will be stripped and the torch will be ruined.

Multiple Extension Outlet

THE multiple extension outlet shown in the illustration is particularly suited for use in locomotive erecting shops. A number of them are in use in the Union Pacific shops.

The device consists simply of a rectangular wooden box mounted on a standard or frame made of 1-inch pipe. There are ten small rectangular holes cut in the box, four on each side and one on each end, and behind each hole is placed a special receptacle. All of the ten receptacles are connected



Multiple Extension Outlet Which Will Serve Nine Portable Extensions

in multiple. A piece of two-conductor reinforced cord with a plug at either end completes the outfit.

At times there are six or eight men at work on a locomotive, each of whom wants to use a portable extension light. It is not practicable to have that many extension outlets at each locomotive location and where all of the outlets are at an end of the locomotive on a column or post it is necessary to have long extension cords.

Well Equipped Engine Terminal on the R. F. & P.

Plant Includes a 30-Stall Roundhouse, a Large Machine Shop and Complete Outside Facilities

A THIRTY-STALL roundhouse, with complete outside and inside facilities and an unusually well equipped machine shop, was completed and placed in operation in January, 1924, by the Richmond, Fredericksburg & Potomac at Richmond, Va. This terminal is especially notable for the extent to which the requirements of future increases in the volume of business were incorporated in the present construction as well as in the provisions for later extensions.

The new facilities, which replace the old Boulton terminal located within the city limits, are located outside of the city of Richmond, adjoining the Acca freight yard. This yard is the freight interchange point between the R. F. & P. and the Atlantic Coast Line and the engine terminal cares for the Atlantic Coast Line power as well as that of the R. F. & P. This includes both freight and passenger locomotives.

Outside Facilities

The general layout of the terminal tract is shown in one of the drawings. It lies at the south end of the freight yard and future expansion will extend toward the north. The inbound and outbound tracks, which lead from the south end of the yard, are operated left-hand. These leads are kept well separated where they approach the main and lead tracks at Acca tower and several cross-overs have been installed in order to prevent any possible blocking of the terminal by derailments or other accidents. An additional outlet is being provided over a lead skirting the freight yard and making connection at its north end. A second track on this lead will care for the wreck train equipment. This arrangement obviates practically all possibilities of bottling up the terminal. The inbound lead serves four inbound tracks, two of which pass over the inspection pits and inbound ash pits. One track forms a direct lead to the enginehouse and the fourth, actually the third on the layout, is for the use of switch engines and for loading ashes. This track ends at the sand storage bin and sandhouse, and on it sand cars are unloaded by the ash pit crane. The other tracks pass under a 1,000-ton Roberts & Schaeffer concrete coaling plant and thence to a Bethlehem 105-ft. twin span turntable. The outbound tracks have two grouped and one separate lead from the turntable, the two track portion branching into a number of engine storage tracks. The main stem of the outbound tracks passes along the coaling plant and outside of the ash pit crane runway over a small outbound ash pit of unique design.

The inspection pits are of concrete construction, 100 ft. long by 3 ft. 6 in. deep. Located centrally is a concrete lined tunnel which connects both pits and the inspector's office. It is reached by a stairway from each pit and a stairway located inside the building. Excellent lighting has been obtained by rows of six 150-watt angle reflectors on each side, set 7 ft. from the center of the track and 9 ft. 6 in. above the base of the rail so that they distribute the light over the running gear of the locomotives. Pit lighting has been obtained by gas-proof fixtures set in recesses in each pit sidewall; the recesses are painted white to secure the maximum reflection.

On the north side of the tracks, parallel to the inspection pits, is a brick tool and inspectors' house 82 ft. long by 16 ft. 9 in. wide. At the incoming end of the building is a locomotive tool storeroom 40 ft. long, in which are stored the shovels, oil cans and enginemen's tool boxes removed from the locomotives as they arrive at the pit. Adjoining the storeroom is a room 22 ft. long, now devoted to electric headlight equipment inspection and repairs. Eventually this room will also be used for such facilities as may be required for the inspection and testing of automatic train control engine equipment. The inspection pit tracks will be sectionalized to permit complete testing of the apparatus while the locomotive is over the pit.

The Incoming Engine Facilities—the Inspection Pit in the Foreground, with the Locomotive Tool and Inspectors' House at the Right

In the west end of the building is the locomotive inspector's office, 20 ft. long. Here the enginemen make out their work reports on the first sheet of a double sheet form, turning it in to the inspector, who enters his inspection report on the second sheet of the form and then despatches the form, through a pneumatic tube carrier system, to the assistant foreman's office in the roundhouse machine shop. While the locomotive is passing over the ash pit and being coaled, the foreman has time to assign it to the most convenient stall for the work required and to have preparations made for the work, if the

available terminal time is short, before the locomotive arrives at the turntable.

The two main ash pits are 250 ft. long, 3 ft. 11 in. wide and 4 ft. deep, lined with vitrified paving brick, and are of the wet type. These pits are served by a 5-ton overhead crane and a 2-yd. grab bucket, the runway for which is 375 ft. long with a 50-ft. span supported by steel columns. The ash loading track also contains a short pit 100 ft. in length, which is used primarily for cleaning the fires of switch engines working in the Acca yard. This greatly facilitates the serving of the local switching power between tricks without disturbing the regular operation of the terminal.

The outbound ash pit consists of a shallow, dry pit, 12 ft. long, located under the outbound track and interconnected with a wet pit of similar size, but of greater depth, under the adjoining ash pit track, where crane service is available. This connection is sloped downward between the tracks and as the ashes are dumped, they are washed down this slope by water delivered through four flat nozzles set in the side wall slightly above the brick bottom of the pit.

One of the Six-Ton Pawling & Harnischfeger Electric Traveling Hoists

The coaling plant has a capacity of 1,000 tons, serves four tracks at one time with individual weighing bins and Strait scales, and is equipped with dual hoisting facilities. It is arranged with two unloading tracks passing over hoppers and terminating in coal storage tracks, which feed by gravity to the plant. It is also arranged with a coal storage layout utilizing the Beaumont cable drag scraper system of handling the coal. With the area now used for storage, the capacity is about 25,000 tons of coal with an average depth of about 15 ft., which is approximately two months' supply for the terminal. This system has greatly reduced the number of cars formerly held for coal storage and has otherwise facilitated the coaling operations of the terminal.

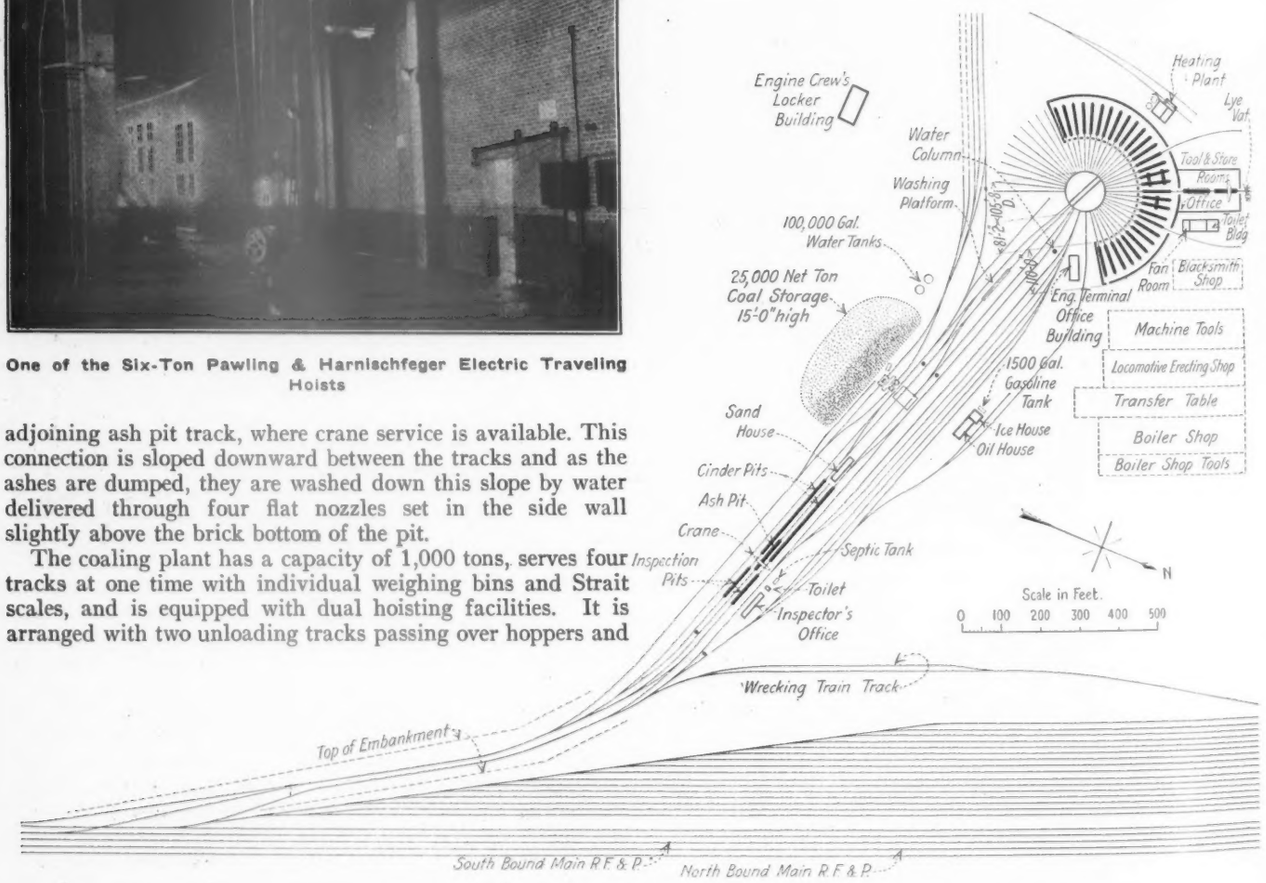
A reinforced concrete washing platform has been placed between the coaling plant and the turntable on one of the inbound leads. Several crossovers secure the necessary flexibility of operation to and from this platform. It is 100 ft. long by 20 ft. wide and is fully equipped with pipe connections for air, steam, water and sewerage.

The Enginehouse

The enginehouse is a 30-stall structure of concrete and brick construction with provision for the addition of 16 stalls when the necessity arises. The angle between tracks is equivalent to 56 divisions of a circle. The stalls are 110 ft. deep, with concrete engine pits 84 ft. long, inside dimensions. The clear door opening is 14 ft. wide by 17 ft. high. The structure is of the monitor type with five bays.

Stalls 11 and 12 are served by two National-Bingham drop tables to handle drivers, and stalls 14 and 15 by pit jacks of the hydraulic type to handle trailer and truck wheels. In these sections the columns were eliminated in order to secure a clear opening between Nos. 11 and 12 and Nos. 14 and 15, for the installation of a 15-in. I-beam upon which 6-ton Pawling & Harnischfeger electric hoists are operated. This installation circles the entire building approximately 10 ft. from the rear or outer circle wall, with switch leads to the drop pits and to the door opening on the material platform alongside the machine shop. Two of these hoists are provided.

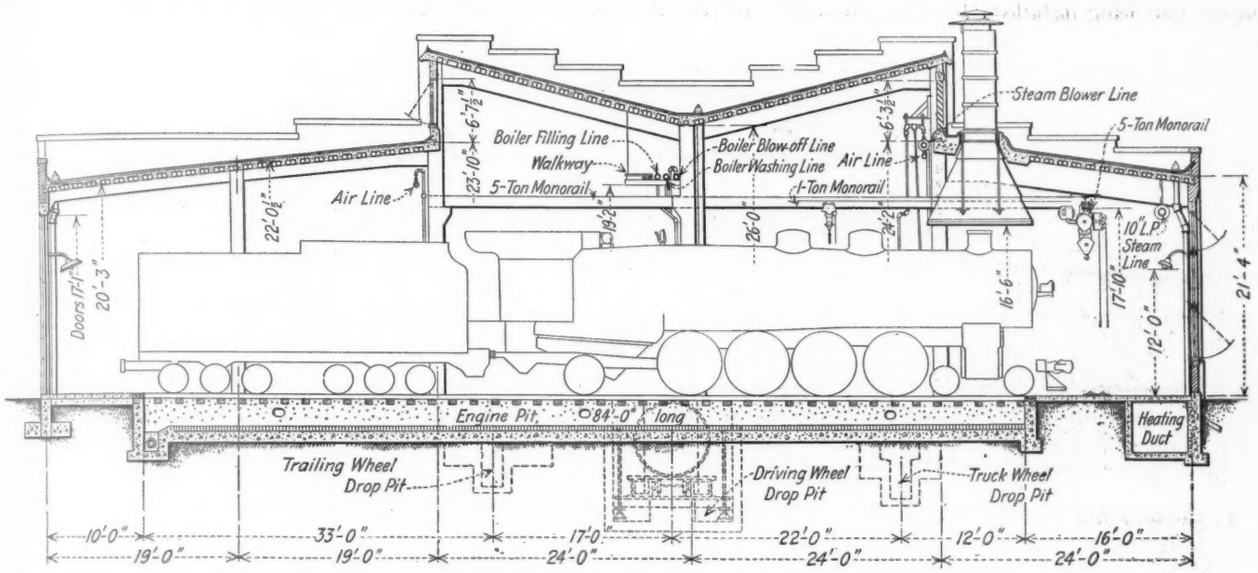
Each engine pit is served by two Cyclone ball-bearing chain hoists of one-ton capacity, operated on 10-in. I-beams set 10 ft. 6 in. center to center and extending over the outer



General Layout of the New Acca Engine Terminal—Proposed Location of Back Shop Is Shown in Broken Lines

three bays within 1 ft. 6 in. of the center line of the 6-ton monorail.

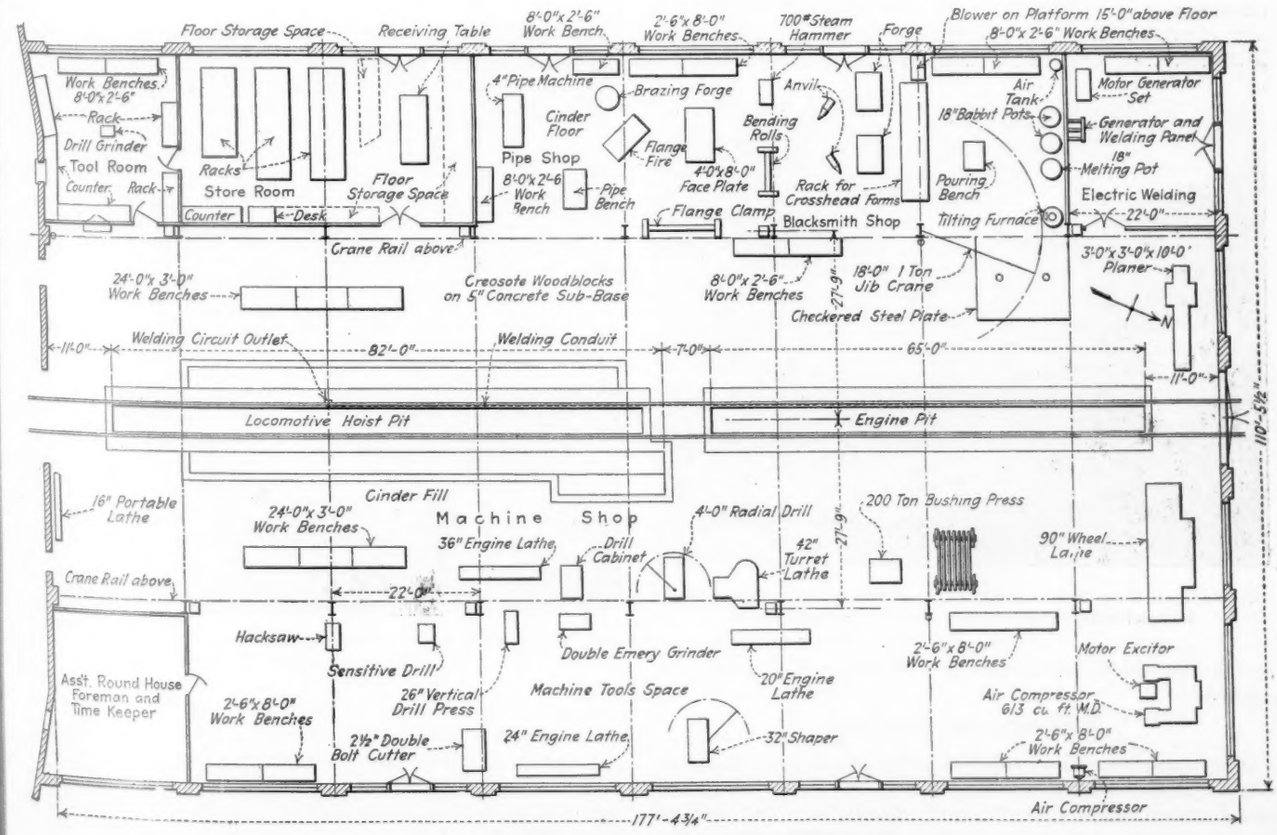
A National boiler washing plant with 18 ft. diameter by 16 ft. high, wood tanks, serves one-half of the house, including stalls 16 to 30. The piping has been well arranged. One of the noteworthy features of this work is the suspension of a walkway alongside the boiler washing service pipes, following the column line under the center of the monitor. Another interesting phase of the piping is the blower drops. These drops are made from American bronze, encased, flexible hose with a Barco joint at each end, to relieve the hose of twisting strains, connecting with a Jenkins Selclo valve controlled from the floor by extension handles. Guard rails encircling the posts prevent the hose from becoming entangled with the lighting fixtures.



A Cross-Section of the Enginehouse Showing the General Arrangement of the Facilities

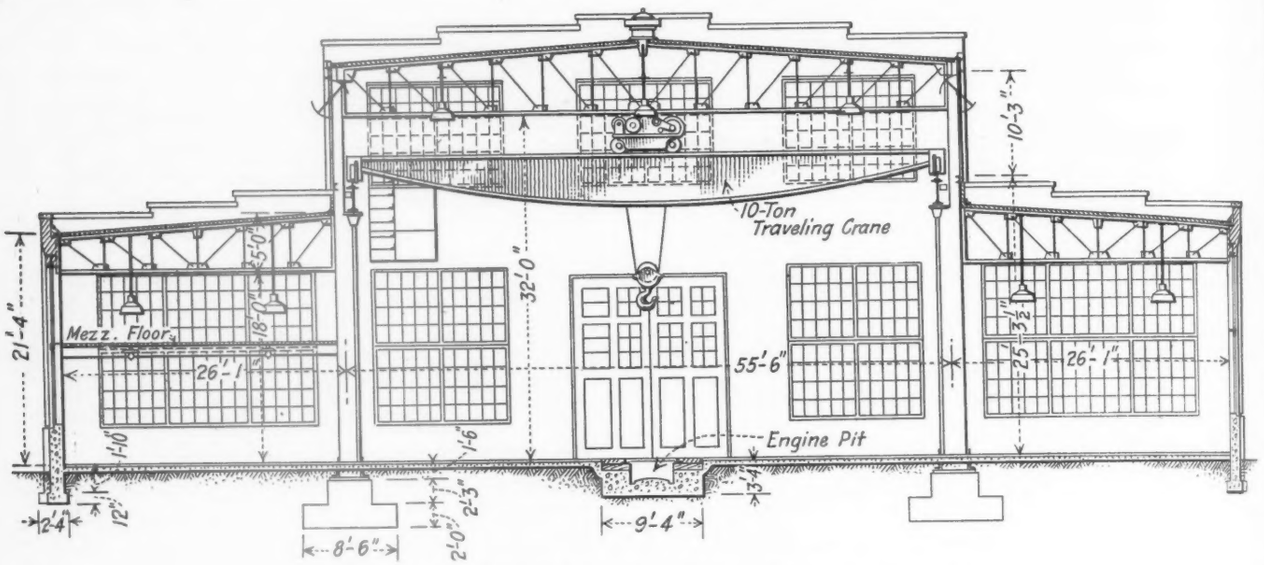
The Machine Shop

The machine shop is connected to the enginehouse opposite stalls Nos. 11 to 15. The drawings show the construction and dimensions. A wood block floor, laid on concrete, is

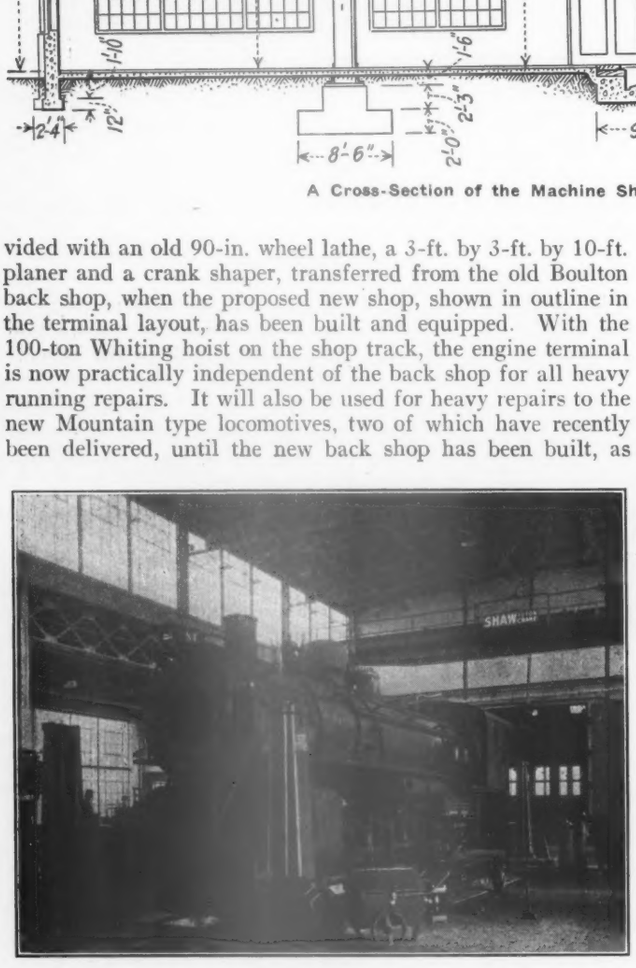


The Machine Tool Layout in the Machine Shop

provided, except in the section allotted to blacksmith work where cinders are used. The tool layout is also shown in one of the drawings. Most of these tools are new, a few only having been moved from the old terminal. In addition to the layout now being installed, the shop ultimately will be provided with an old 90-in. wheel lathe, a 3-ft. by 3-ft. by 10-ft. planer and a crank shaper, transferred from the old Boulton back shop, when the proposed new shop, shown in outline in the terminal layout, has been built and equipped. With the 100-ton Whiting hoist on the shop track, the engine terminal is now practically independent of the back shop for all heavy running repairs. It will also be used for heavy repairs to the new Mountain type locomotives, two of which have recently been delivered, until the new back shop has been built, as the pits in the old shop are too short to take in the new engines.



A Cross-Section of the Machine Shop, Looking Toward the Outer End

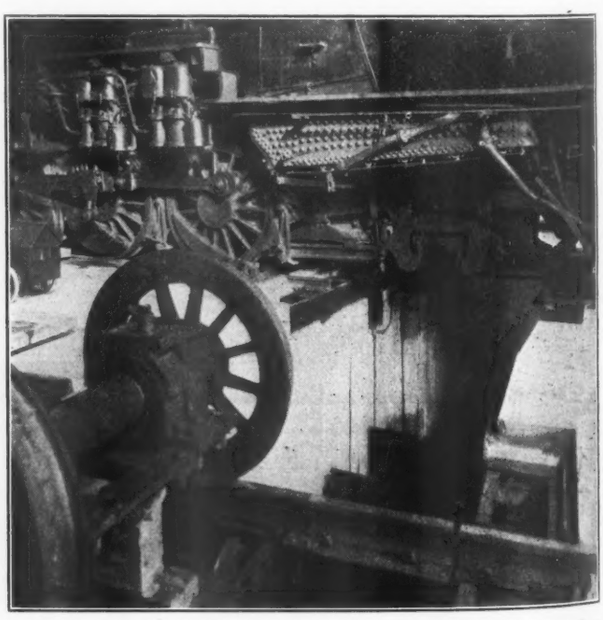


The Machine Shop Track Contains Two Pits; That Adjoining the Enginehouse Is Equipped with a Whiting Hoist

Heating and Lighting

The enginehouse and machine shop are heated by an indirect system discharging from two separate American blower installations into a concrete duct around the outer wall of the enginehouse and down through the machine shop. Six outlets are provided in each engine pit and there are additional outlets along the outer circle wall.

The enginehouse is effectively lighted artificially by means of Maxolite dome reflectors, using 100-watt lamps. There are nine of these reflectors for each stall, located 12 ft. from the floor and at an angle of 15 deg. From the inner circle, they are installed on a 1-1-2-2-2-1 arrangement, the single installations facing down the column line and the double installations facing to the sides, thus giving both longitudinal and side flood lighting at the rate of 900 watts per stall. All wiring is in conduit embedded in the concrete and plug receptacles are provided in the pits and on the columns. In the machine shop, the natural lighting is exceptionally effective because of the large expanse of steel sash windows in the sides and outer end of the building. The artificial lighting is also effectively cared for by the liberal employment of dome reflectors. Longitudinally, the column spacing is 19 ft.



The Drop Tables Are Installed for Handling Drivers; in This Case a Trailer Has Been Dropped

4 in. and for each section there are four Maxolite 200-watt lights in each side bay, and three 500-watt lights in the central bay.

Oil House, Crews' Quarters, Etc.

Other buildings include a small combined power, heating and boiler washing plant; a combined heating plant and shop employees' locker and toilet facilities; an oil storage and ice house; a terminal office building; an inspector's office building and an engine crews' rest and locker building.

The oil and ice house is located at the north side of the engine storage tracks, across from the coaling station. This is a one-story building, with basement, and is 90 ft. long by 30 ft. wide. The ice house, which occupies the west end of the building, is insulated with cork inside of brick walls, and has a capacity for 1½ cars of ice. This is ordinarily about one month's supply for the Richmond terminal.

In the basement of the building are located five tanks of 5,000 gal. capacity, one tank of 2,000 gal. capacity and two tanks of 1,000 gal. capacity. There are also seven 600-gal. and two 300-gal. tanks. The six larger tanks are provided with car filling connections and all the tanks are served by floor filling boxes.

The oil delivery room on the first floor contains 17 one-gallon Bowser measuring pumps, moved from the old terminal, and two tanks for the preparation of car journal packing. A storage room with a capacity for 1½ cars of waste, is also located on this floor. The building is fitted with steam fire extinguisher pipes, separately controlled for each floor, from outside the building.

The engine crews' rest and locker building is an attractive structure both from the outside and inside. It is built of brick and concrete surmounted by a gabled roof of red shingle tile. The second floor has a wide balcony extending around three sides and over a small portico on the fourth. This building contains a large reading and lounging room, locker rooms and toilet facilities on the first floor and dormitories on the second floor. Separate quarters are provided for the employees of the Richmond, Fredericksburg & Potomac, and those of the Atlantic Coast Line and the Norfolk & Western. A small part of both the first and second floors has been set aside for the use of the negro firemen of the A. C. L., completely detached from the remainder of the building. At one end of the second floor is a kitchen for the use of the men who wish to prepare hot food. It will be equipped with a gas stove, a modern sink and running water, a table and benches.

11-15-23 20M Form MP—38

RICHMOND, FREDERICKSBURG & POTOMAC RAILROAD COMPANY
ACCA LOCOMOTIVE TERMINAL

ENGINEMAN'S WORK REPORT

INSTRUCTIONS—Each Locomotive and Tender must be inspected after each trip or day's work, and report made on this Form, whether needing repairs or not. Proper explanation must be made hereon for failure to repair any defects reported, and the Form approved by Foreman before the Locomotive is returned to service. Verbal reports or reports not signed by Engineman are not acceptable.

Locomotive Initial _____ Locomotive Number _____

Date _____ Train Number _____ Arrived at Pit _____ M.

NOTE—START EACH ITEM ON SEPARATE LINE.

	Repairs Needed	Repairs Made By
Machinery		
Stoker		
Boiler		
Ash Pan		
Cab and Boiler Fittings		
Air Brake and Piping		
Electrical Equipment		
Tender and Other Work		

Condition of Water Column and Glasses _____ Gauge Cocks _____

Condition of Injectors R _____ L _____ Brakes _____

Safety Valve Lifts at _____ Pounds. Seats at _____ Pounds.

Main Reservoir Pressure _____ Pounds. Brake Pipe Pressure _____ Pounds.

Is Engine Blowing? _____ Does Engine Drop or Throw Fire? _____

How is Engine Steaming? _____

Name of Fireman _____ Engineman's Signature _____

The above Work has been performed, except as noted, and the Report is approved:

_____ Foreman

The Engineman's Work Report Is the First Sheet of the Combined Work and Inspection Report

11-15-23 20M Form MP—38

INSPECTOR'S REPORT

NOTE—START EACH ITEM ON SEPARATE LINE.

Locomotive Initial _____ Locomotive Number _____

Date _____ Inspection Completed _____ M.

	Repairs Needed	Repairs Made By
Machinery		
Stoker		
Boiler		
Ash Pan		
Cab and Boiler Fittings		
Air Brake and Piping		
Electrical Equipment		
Tender and Other Work		

Compressors and all other Air Equipment tested by me and is in good condition and in compliance with the Law

_____ Air Inspector.

Headlight and all other Electrical Equipment tested by me and is in good condition

_____ Electrical Inspector.

Gauge Cocks, Water Glasses (and Column, if used) blown out by me; all ports left open and connections tight and in good condition

_____ Inspector.

Low water Alarm tested by me and is in good condition

_____ Inspector.

Ash Pan examined by me and is in good condition

_____ Inspector.

The above Work has been performed, except as noted, and the Report is approved:

Ready for Service _____ M.

_____ Foreman

The Terminal Inspector Makes His Report on the Second Sheet of the Form

Operating Conditions

The Acca engine terminal turns from 80 to 100 or more locomotives a day during the busy season. Of this number, about 24 are switch engines and the remainder are divided about equally between freight and passenger service. R. F. & P. locomotives constitute about 80 per cent of the power turned, the remainder being Atlantic Coast Line locomotives and the locomotives from two Norfolk & Western passenger runs between Norfolk and Richmond. With the exception of the engines operating in the Potomac Yard (Washington, D. C.), practically all of the 99 locomotives owned by the R. F. & P. depend on this terminal for running repairs.

Arrivals and departures are fairly well distributed throughout the 24 hours, with no marked peaks and no long periods of idleness. The heaviest periods are probably those between six and nine o'clock in the morning and five and eight o'clock

in the evening. During the former period, on the basis of a total daily movement of 80 engines through the terminal, 10 to 12 road engines and 9 yard engines are despatched, and 8 road engines arrive at the inspection pits. During the latter period, 12 road engines are despatched and 10 or more road engines arrive at the ash pit. The heavy afternoon switch engine movement takes place between four and five o'clock. The coal issued runs about 550 tons a day, or an average of about 7 tons per locomotive turned, including the switch engines.

It is evident that, with no future additions, the terminal is capable of effectively handling a much larger engine movement than it is now called upon to do, and that the outside facilities have ample capacity to balance the increased size of the roundhouse, when conditions require the building of the additional stalls. Something of the future for which this capacity has been provided, is indicated by the fact that the northbound perishable movement, which now constitutes, roughly, one-quarter of the total freight tonnage of the road, has been doubling approximately once in every five years.

The new terminal was developed and constructed under the direction of W. D. Duke, general manager; H. J. Warthen, superintendent motive power; L. Budwell, mechanical engineer, and E. M. Hastings, chief engineer. The plans were prepared and the construction carried out by the Arnold Company, Chicago.

Portable Oil Reservoir

By E. A. Miller

A PORTABLE oil reservoir that has proved its usefulness around railroad shops and terminals is shown in the drawing, Fig. 1. It consists essentially of a 14-in. by 33-in. reservoir for containing the oil, on top of which is mounted a separator through which the air is passed from an air line for the purpose of forcing the oil to the burners. This device is mounted on a truck carried on two standard 21-in. baggage truck wheels, bored and faced to fit a 1½-in.

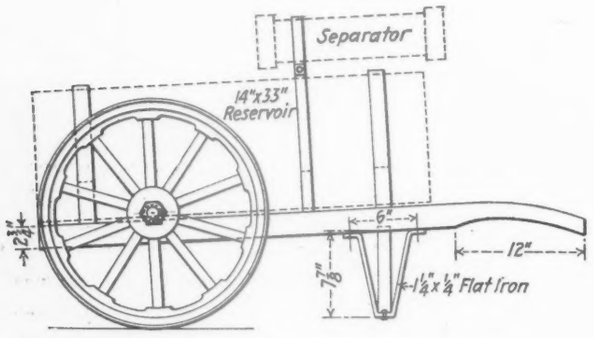


Fig. 1—Assembly Drawing of Reservoir and Truck

by 3-in. axle. Air is passed into the separator at the air inlet, as shown in Fig. 2, from an air line, from whence it is carried through the piping, as shown in the end view of Fig. 2 to the oil reservoir.

The air enters the oil reservoir at the top through a ¾-in. globe valve. This pressure on the oil causes it to be forced out through the 1½-in. wrought iron pipe which extends the entire length of the reservoir to within ½ in. of the extreme end. A ½-in. needle angle globe valve allows the oil to enter the burner through the burner connection. There is a ½-in. globe valve placed between the oil pipe and the air pipe, which can be adjusted for purposes of atomization.

Provision has been made in the piping arrangement for two burner connections. Either side can be operated separately by means of the two globe valves, which control the air from the separator and the oil from the reservoir.

This reservoir has been used successfully in providing oil for burners to thaw out ash pans, coal and sand pipes, as well as to operate car heating coils. When used for preheating for thermit welding, the burner connection is attached to a piece of ⅜-in. wrought iron pipe and is used without any

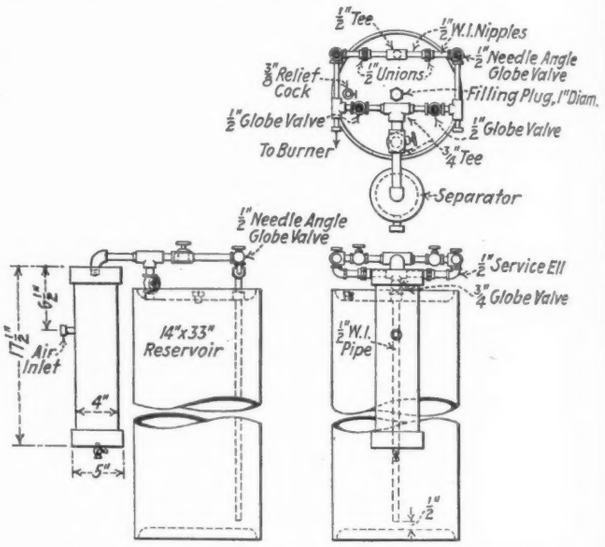


Fig. 2—General Arrangement of Reservoir and Piping

burner. The apparatus is capable of handling various types of oil and can also be used for whitewashing. However, it is necessary to substitute a ½-in. angle globe valve for the ½-in. needle angle globe valve shown in Fig. 2.

Convenient Facilities for the Air Brake Room

By F. G. Bonzheim

THE two devices illustrated in the drawings are simple to make from material which is likely to be available at any shop, and both are very useful in the air brake department.

The device shown in Fig. 1 is a power vise for holding freight car pistons while renewing the packing leathers or tightening the studs and nuts in the repair track air brake room. The pistons are removed from the car and delivered to the test rack with the non-pressure cylinder head and spring clamped to the piston sleeve. This assembly is very difficult to hold in an ordinary bench vise and can be handled with much greater facility in the device shown.

The complete device consists of a Shoemaker firedoor cylinder and two jaws, one moveable and the other adjustable, all of which are mounted on a steel bench plate. The moveable jaw, which slides on the plate, is operated by the air cylinder through the medium of a lever having a two to one ratio. The other jaw, which, in operation, is stationary, is made adjustable to accommodate brake cylinder pistons of different diameters. The adjustment is provided by drilling two holes in the jaw, either one of which may be selected for the insertion of the lock pin, which is inserted through the jaw into a hole in the bench plate. The remainder of the details of the device are clearly shown in the drawing.

In Fig. 2 is shown a simple work stand for holding distributing valves of the No. 6 E.T. brake equipment. It permits the adjustment of the valve in any position for dis-

mantling, facing slide valve seats, fitting rings and assembling.

The device is made entirely from scrap material. The standard is a 14-in. passenger car type brake cylinder piston. The flange on which the distributing valve is mounted is

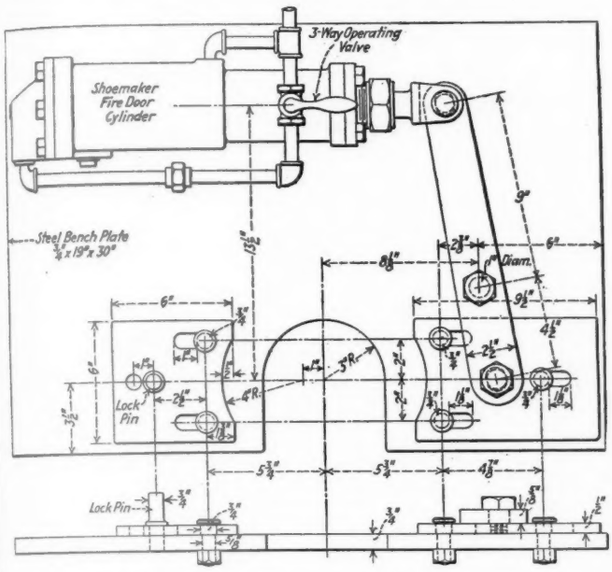


Fig. 1—A Power Vise for Holding Freight Car Piston and Non-Pressure Head While Changing the Packing

made of a 9½-in. air pump piston. The stem of the piston is passed through the jaws of a split nut, which permits the face plate to be rotated to any position, either about the axis of the stand or about its own axis. When once in the position desired, further movement around either axis is pre-

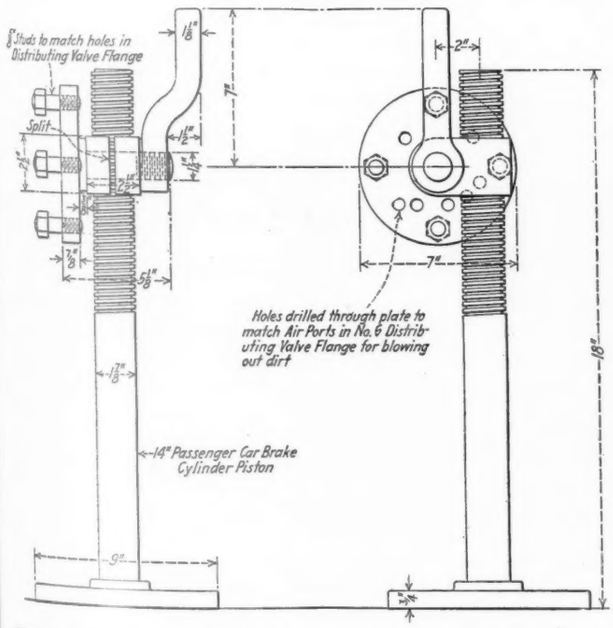

Studs to match holes in Distributing Valve Flange
Split
Holes drilled through plate to match Air Ports in No. 6 Distributing Valve Flange for blowing out dirt
14" Passenger Car Brake Cylinder Piston

Fig. 2—An Adjustable Stand for Use in Repairing Distributing Valves

vented by tightening the binding nut on the end of the face plate stem.

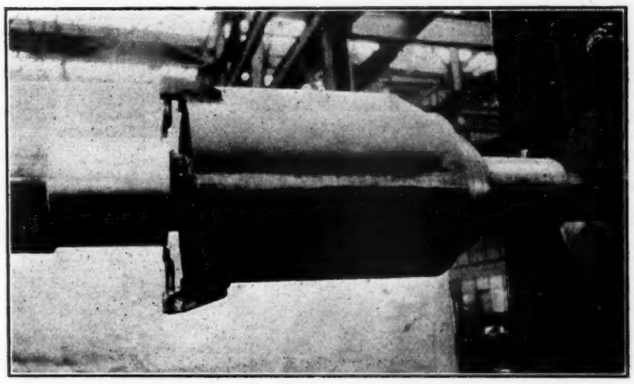
The face plate is fitted with studs which correspond with the bolt holes in the distributing valve flange. Holes are also drilled through the plate to register with the air passages in the distributing valve flange, to permit blowing out the passages with air pressure.

Turning Mounted Crank Pins on a Quartering Machine

By A. E. Nye

General Machine Foreman, Santa Fe, Albuquerque, N. M.

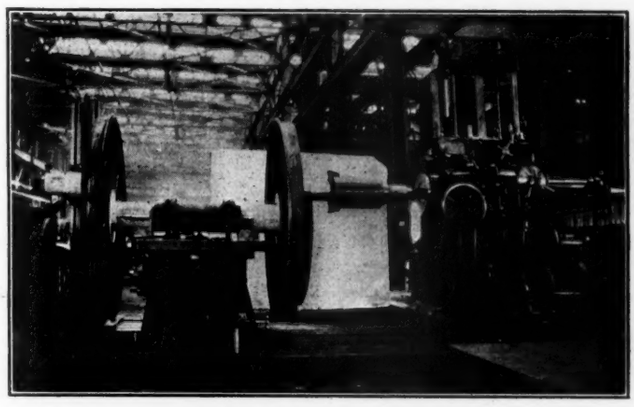
A DEVICE for turning mounted main crank pins on a Pawling & Harnischfeger horizontal boring and quartering machine is shown in the illustration. The wheels are set up with the axle resting in V-blocks which are tongued to fit the slots in the table. This method of setting the blocks places the axle in line with the spindle of the



The Turning Attachment Is Equipped with a Roughing and Finishing Tool

machine. The journals are calipered and any variation in size is remedied by placing shims under the smaller journal.

The first pin to be turned is plumbed with the center of the axle and the spindle of the machine is centered with the proof line on the end of the axle. It is then raised an amount equal to the stroke so that the center of the spindle is located at what should be the correct center of the crank pin.



With This Attachment All Setting Is Done with Respect to the Quarter and Stroke

This may be checked by graduations on the housing of the machine.

The turning attachment consists of a box, shown in the illustration, which is keyed to and extends out from the end of the spindle. It is a hollow cylindrical casting with two tool holders welded to the circumference opposite to each other. Two tools are used at the same time, the leading tool to do the roughing and the following tool the finishing. As

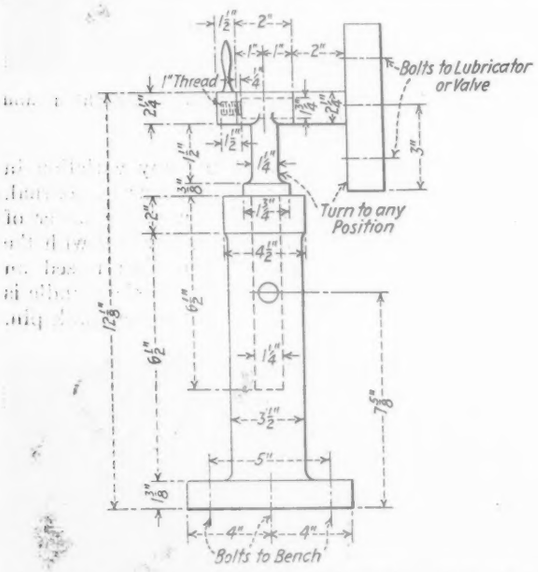
the cutting is done on opposite sides, the tendency to chatter is eliminated. One cut is generally sufficient to true the pin and leave a small witness mark.

The second pin is plumbed by quartering with the pin already finished and is then set for the stroke by the procedure already described. This system insures the pins being turned parallel with the axle. It also results in greater accuracy as all the setting is done with respect to the quarter and the stroke.

A similar attachment, but smaller in size, is used for turning the front, back and intermediate crank pins.

Lubricator and Air Brake Valve Holder

A CONVENIENT bench device for holding lubricators or air brake valves while being repaired, is shown in the sketch. A vertical plate, drilled to suit the holder on the bracket of the lubricator or valve, is attached to a pin 5¼ in. long and 2¼ in. in diameter. This pin is turned down to 1-11/16 in. in diameter, 2 in. from the back of the plate, and 1¾ in. along the pin where it is again turned down to take a 1-in. thread. The horizontal arm, which is 2 in. long, is cored to 1¾ in. diameter. As shown in the sketch, the pin, with the vertical holding plate attached, is passed through the horizontal arm and a hand screw tapped for a 1-in. screw thread is screwed on the end. This arrangement permits the workman to turn the lubricator or air brake



Sketch of Bench Device for Holding Lubricators or Air Brake Valve

valve to any position and hold it securely by tightening the hand screw.

The horizontal arm is cast integral with the standard, which has an extension of 6½ in. down into the base. The base is 9⅞ in. high and 8 in. in diameter, and is provided with four holes so that it can be bolted to the bench. A hole is drilled and tapped for a set screw 7⅝ in. from the bottom of the base and by tightening the set screw, which should be provided with a handle, against the extension, the standard can be held at any desired height. The vertical holding plate can also be held at any convenient angle to the front of the bench and locked in position. It has been found that this device facilitates the work, on account of the fact that it can be changed easily and quickly to any desired position and securely locked with comparatively little effort on the part of the workman.

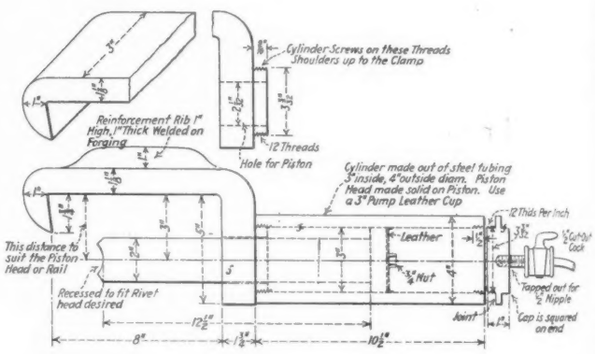
Holder-on for Bullring Rivets

By F. W. Lampton

General Foreman, St. Louis-San Francisco, Springfield, Mo.

A HOLDER-ON for bullring rivets is shown in the sketch. This tool was devised for holding on the rivets driven in a new type of bullring. There were many loose rivets resulting from driving and holding on with a long stroke hammer and a dolly bar. By using this tool and driving the rivet with a long stroke a good tight job could be obtained with less manual effort. The use of this tool eliminates one man from the gang.

This tool can be made at any shop as there is just one forging to be made. The cylinder is made out of tube stock. A reinforcement rib is welded on top of the forging so as to


Cylinder Screws on these Threads Shoulders up to the Clamp
Reinforcement Rib 1" High, 1" Thick Welded on Forging
12 Threads
Hole for Piston
Cylinder made out of steel tubing 3" inside, 4" outside diam. Piston Head made solid on Piston. Use a 3" Pump Leather Cup
12 Thds Per Inch
This distance to suit the Piston Head or Rail
Leather
¾" Nut
Recessed to fit Rivet head desired
Tapped out for ½" Nipple
Joint
Cap is squared on end

This Holder-on Eliminates One Man on Bullring Riveting

give it added strength. The piston is turned out of a piece of steel at one end and conforms with the shape of the head desired on the rivet. The other end is turned to a working fit in the cylinder with a 3-inch pump leather studded on the end to make it air-tight. A removable cap is placed on one end of the cylinder so that repairs can be made and the tool inspected when needed. The other end of the cylinder is screwed on the forging proper. With 90 pounds of air on this piston you can be assured of a tight job on all rivets.

Revolving Tool Rack

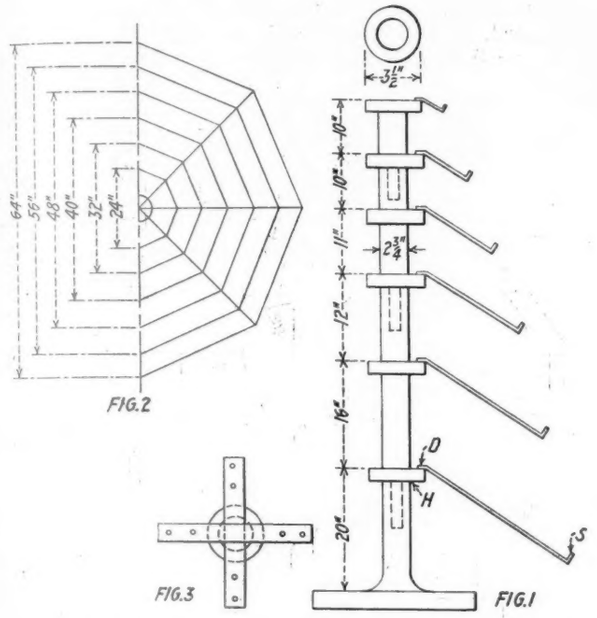
By Joseph Smith

A TOOL rack with a number of convenient features has recently been built and placed in service in the Lorain, Ohio, shops of the Baltimore & Ohio. Its construction and installation was under the supervision of K. E. Floeter, general foreman. As shown in the drawing, the rack is built in the shape of an octagon and the shelves are tilted so that the tools can be easily seen as they are revolved around the stand or center post.

Referring to Fig. 1, of the drawing, the center post is composed of four separate pieces. The lower portion is welded to the stand, Fig. 3, and the upper portion turns on a recessed collar, equipped with ball bearings, at *H*. This arrangement makes the rack easy to operate by the tool room attendant. The stand is made of 6-in. by 1-in. by 36-in. wrought steel and is constructed by offsetting one piece at the center so as to fit snugly over the other and then welding them together.

The tool trays are made from a ⅛-in. steel plate, pressed into the form of a cone frustum having the outlines as shown in Fig. 2. Each cone is made in two sections. This arrangement makes it comparatively easy to place a section on the

top of each collar on the center post and then weld at the point *D*. After both sections have been welded to the collar, the tray is then completed by welding the seams. Each tray has a slope of 30 deg. The flange *S* is made by allowing



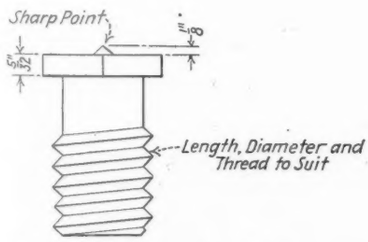
A Handy Rack for Tools That Is Being Used in a Railroad Shop

about an inch more of material than is required to make the cone and when the cones are bent to shape the flanges are turned up by hand.

Center Screws for Laying Off Bronze Hub Liners

By E. H. Fitcher

IN laying out bronze liners for hub plates, or for the shoe and wedge faces of driving boxes, difficulty is sometimes encountered in locating the holes in the bronze plate because of the irregular location of the holes in the hub or shoe and



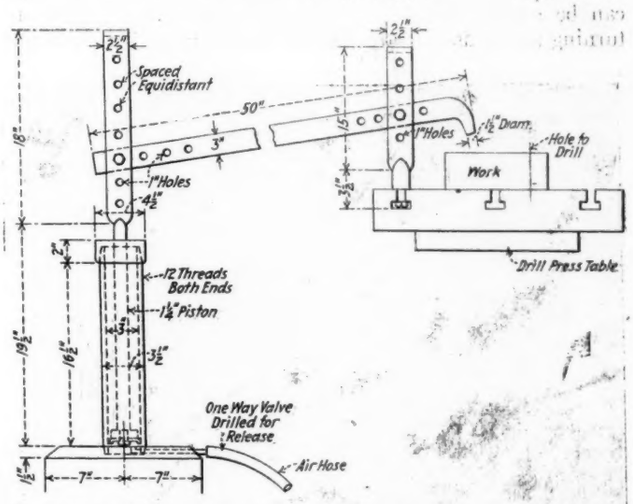
A Center Punch Stud for Laying Out Bronze Hub Plates

wedge faces. By the use of a special stud, shown in the sketch, this difficulty has been overcome. Accurately centered on the head of the stud is a sharp point, which serves as a prick punch. Before laying out the liners, these studs are screwed into the holes in the part to which the plates are to be applied. The plates are then placed in position and tapped lightly with a hammer. The sharp pointed steel stud center punches the bronze plates, which are then ready for drilling.

This device was developed by E. R. Woody, master mechanic, Chicago division, of the Chesapeake & Ohio.

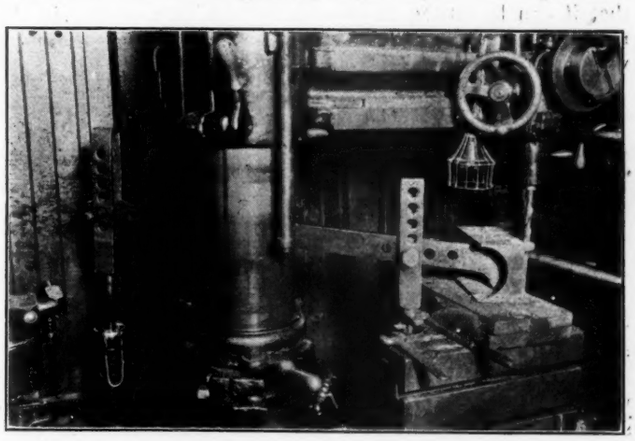
A Portable Air Clamp

A PORTABLE clamp, operated by compressed air, that has proved to be especially valuable for holding work on drill press tables, is shown in the illustration. The construction of the device is very simple and, as shown in the sketch, it contains few parts. It consists of a 14-in. base, to which is attached an air cylinder 3½ in. in diameter. The piston rod has an extension through which a number of one-inch holes, spaced equidistant, are drilled. The holding arm, or lever, is also provided with a number of one-inch



Sketch of Clamp for Holding Work on Drill Press Table

holes at the end. This arrangement allows the operator to vary the length of the lever arm or its height on the piston rod by simply changing the location of the pin. The lever arm also has a number of one-inch holes for purposes of adjustment at the fulcrum. It is 50 in. long and is forged down at the end to 1½ in. diameter. This end is turned down, as shown in the sketch, to hold the work securely on the table. The fulcrum consists of an upright forging which can be fitted into one of the grooves of the table. It is provided



View Showing Portable Air Clamp in Operation

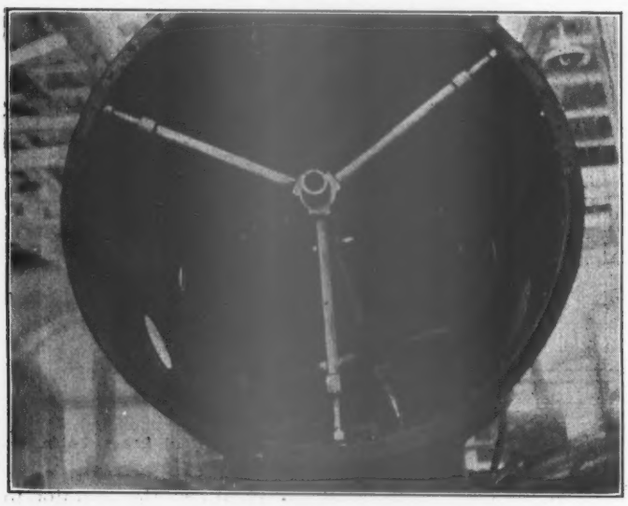
with one-inch holes spaced equidistant so that the height from the table of the holding end of the lever arm can be increased or decreased as required.

The illustration shows the clamp set up for holding work on a single spindle drill press. Its use saves considerable time, for all that is necessary to clamp or release the work is to operate the valve attached to the column of the drill press in a convenient location for the operator.

Jig for Drilling Cylinder Saddle Bolt Holes

By E. A. Murray
Shop Superintendent, Chesapeake & Ohio, Huntington, W. Va.

A CONVENIENT device for holding the air motor in a radial position while drilling bolt holes for the cylinder saddle, is shown in the illustration. It consists of a center bar, which is supported at the front end by three adjustable legs set into the smokebox ring. Each leg can be easily adjusted to different smokebox diameters by turning the studs that are screwed in the ends. The back end



This Device Holds the Air Motor in a Radial Position for Drilling

of the center bar rests in one of the tubes in the front flue sheet.

The feed screw of the air motor used for this work is made considerably larger than the standard screw and the top end is made fast to a sleeve that encircles the center bar. The device is strong enough to support the entire machine so that it can be swung to any desired position. It is simple in construction, inexpensive to make and has proved to be very efficient.

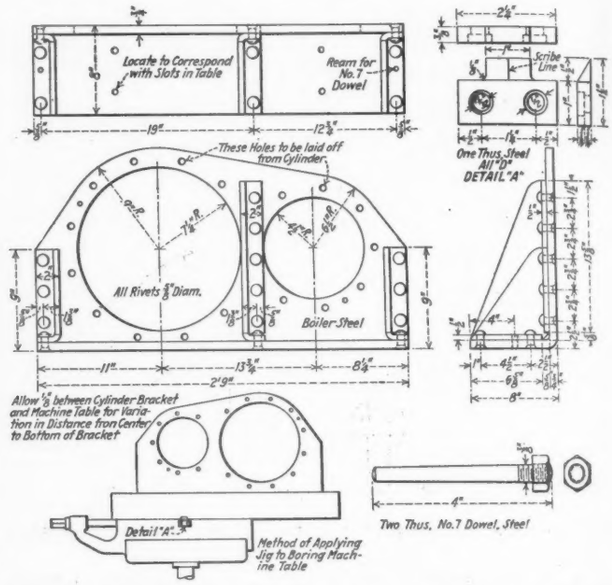
Jig for Reboring 8½-inch Air Pump Cylinders

By E. A. Miller

A JIG for reboring 8½-in. cross compound air pump cylinders on a horizontal boring mill, is shown in the drawing. It is made from a ¾-in. steel plate, bent at right angles so as to form a base 8 in. wide. The base is provided with holes which correspond to the slots in the table so that it can be bolted down in the usual manner. The vertical flange has two holes which serve as limit gages for the operator and is securely braced to the base by three reinforcing angle webs of ½-in. steel plate. The cylinder is bolted to this flange by means of the studs used to hold the cylinder head. The bolt holes can be laid off from one of the cylinders as the location of the studs is standard on all pumps.

In order that the jig may be set up square with the horizontal bar of the machine, two small holes are drilled and reamed in the base of the jig and down into the table of the machine for No. 7 dowels or taper pins. By placing the dowel pins in the holes before tightening the jig to the table it can be set up any number of times with the cylinder in perfect alignment with the horizontal bar. The dowel pins are provided with nuts on their upper ends, as shown in the drawing, and by giving the nut about two turns, the dowel is loosened, so that it may easily be withdrawn.

The detail *A*, which is shown on the drawing, is a marking device which is fastened by machine screws to the stationary bed of the machine under the table. When once the jig is properly located, lines are scribed on the end of the table, one in the vertical plane of the centerline of each of the two bores. When setting for the high pressure cylinder, the proper line on the end of the table must be set opposite the line scribed on the marker, which indicates the correct position on the stationary bed. Then all that is necessary in order to rebore the low pressure cylinder is to move the table over 13¾ in. until the mark showing the second centerline coincides with the scribed line on the marker.


Locate to Correspond with Slots in Table
Ream for No. 7 Dowel
19"
12⅝"
These Holes to be laid off from Cylinder
All Rivets ⅞" Diam.
Boiler Steel
11"
13¾"
8¼"
2'9"
Allow ⅛" between Cylinder Bracket and Machine Table for Variation in Distance from Center to Bottom of Bracket
Detail "A"
Method of Applying Jig to Boring Machine Table
Scribe Line
One Thus, Steel All "D" DETAIL "A"
Two Thus, No. 7 Dowel, Steel

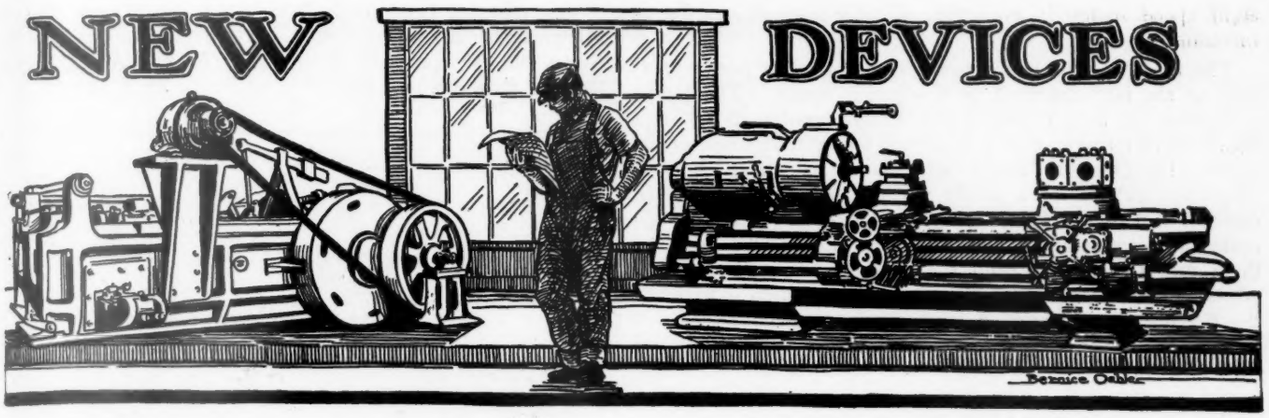
This Jig Correctly Alines the Air Pump Cylinders for Reboring

Reclaiming the Metal One-time Container

THE growing practice of using metal one-time containers for the shipping of paints, oils and other liquids has proved to be economical, with only a single exception, to many large railway systems. These metal containers have heretofore been thought incapable of being reclaimed for further service.

Many lines have experimented in salvaging the metal one-time container, but to date the Canadian Pacific seems to have made the most thorough investigation of the subject. Old paint pails are shipped to the Angus Shops after their contents have been used. Here they are dipped in a tank of hot Wyandotte solution. This removes the paint and leaves the sheet metal clean and practically as good as new, without affecting the surface of the metal or attacking the solder where the metal is joined together.

Making of the metal one-time container into a "many time" container is possible by providing shops with the cleaning solution.

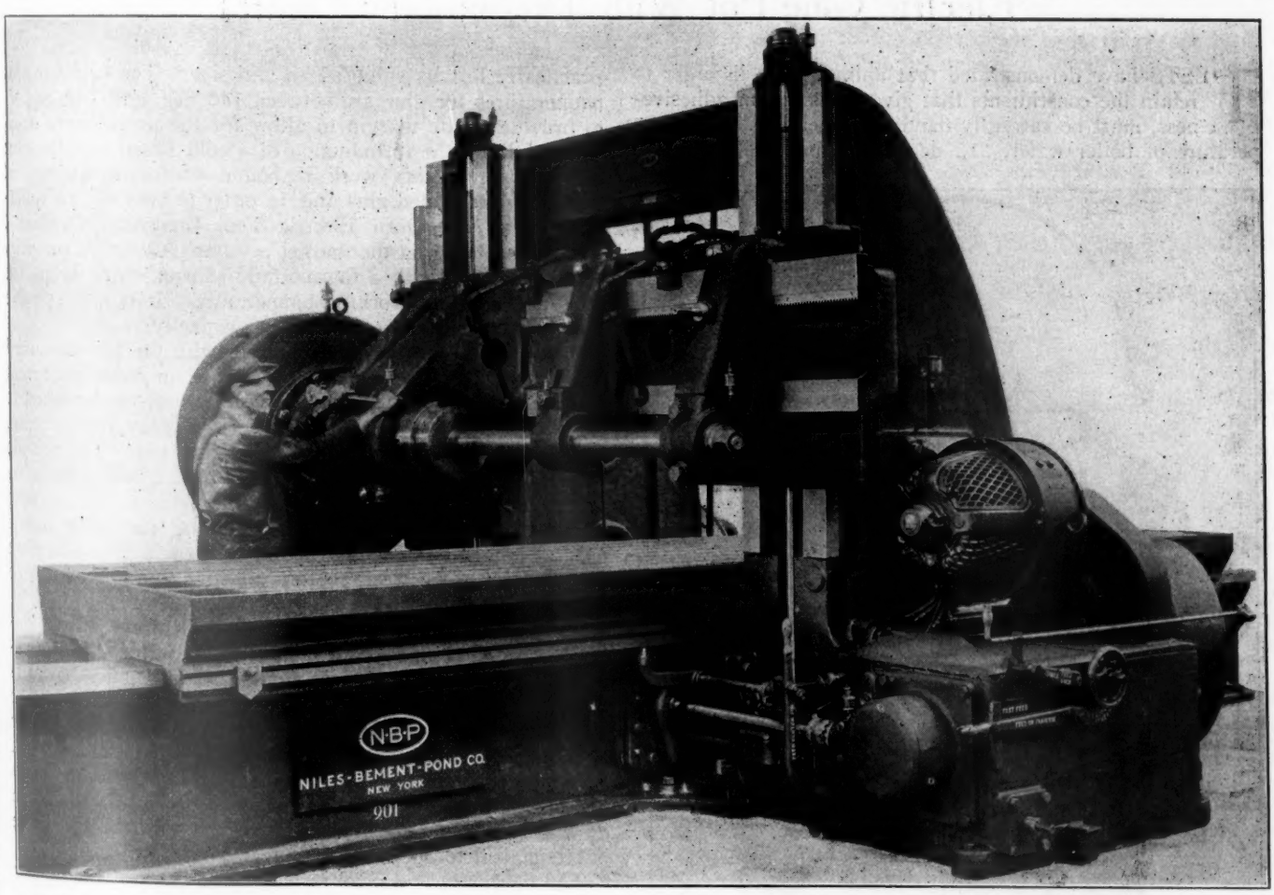


A 58-in. Heavy Duty Locomotive Rod Milling Machine

A RECENT addition has been made to the line of heavy rod milling machines built by the Niles-Bement-Pond Company, Philadelphia, Pa. The machine is equipped with a 75-hp. motor, and will absorb the full motive power if the cutters will stand up to this demand. It is designed throughout so that should cutters become available that will withstand the increased hard usage, the machine may be equipped with a 100-hp. motor. Special attention has been given in the design to such features as smooth cutting action, suitable range of table feeds for the work, convenience of manipulation and proper lubrication.

The spindle is driven by a large manganese bronze worm wheel of coarse pitch, and this wheel engages a hardened steel worm fitted with a ball thrust. Both the worm and worm wheel run in a bath of oil. The large diameter of the worm wheel, together with the tangent type of gearing, tends to eliminate any chatter and preserves the edges of the cutters.

The drive shown in the larger of the two illustrations, is for direct current. A variable speed motor is used with the same range of speed as required by the cutter arbor. Thus a full speed range is obtained without the introduction of change gears. When only alternating current or a con-



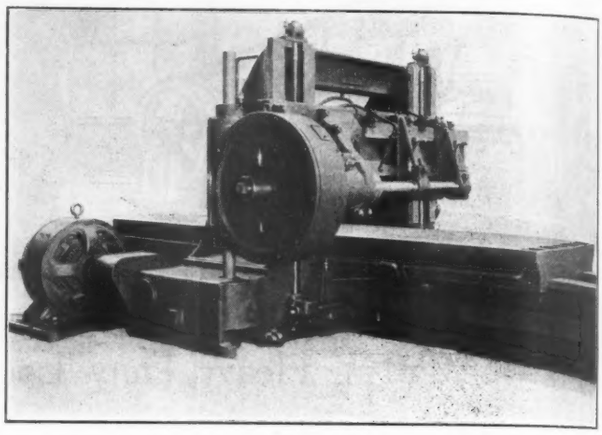
This Machine Is Equipped with Gearing of Extra Strength in Order to Meet Cutting Demands That May Develop in the Future

stant speed motor is available, suitable change gearing is introduced.

The table has the usual power feeds and fast power traverse on the bed, operated by a separate motor. The power is transmitted by a bronze spiral pinion running in a pocket of oil which engages with a steel rack on the under side of the table. The cross rail has a rapid power adjustment in both directions as well as a power vertical feed for raising the cutter out of the work. The downward feed is manually operated as a safeguard against breaking cutters when sinking them into the work. Both the power feed and the rapid adjustment are operated by the same motor, which is wired to the driving motor panel in such a way that it stops when the driving motor is shut off. This motor also may be used for rapid traverse of the table or rail when the driving motor is not in operation. The feed motor has a special control so that it slightly eases off its pulling power when the cutter meets unusual resistance due to excess metal or hard spots.

The machine is equipped with a complete cutting fluid circulating and draining system. The fluid flows to the cutters by gravity from a tank in the top cross piece between the housings and drains from the table to a lower reservoir from which it is pumped back to the tank.

The distance between the housings is 58 in. and the over all width of the table is 54 in. The length of the table between the end pans is 16 in. and the maximum distance between the table and the center of the arbor is 32 in.



Rear View of Rod Milling Machine Designed for Heavy Duty

Electric Glue Pot With Thermostatic Control

TESTS have demonstrated that animal glue, in order to retain the constituents that give it maximum adhesiveness, must be carefully handled in heating. The temperature of boiler water, 212 deg. F., is much higher than the critical temperature of glue, which is about 155 deg. F. At this temperature glue begins to break up and, by evaporation, lose its most valuable elements, and at 185 deg., it has practically lost its value as an adhesive. The best working temperatures for glue are between 140 deg. and 150 deg. F. to provide a safe margin to allow for the temperature drop, which follows the introduction of a cold brush into the glue pot. Unsatisfactory work is bound to follow the use of under or over-heated glue and, in order to meet these requirements, the Van Dorn Electric Tool Company, Cleveland, Ohio, has placed on the market a water-jacketed, electrically heated glue pot with a thermostatic control which keeps the glue at the correct working temperature. It is made in one size only, with a pot of two quarts capacity.

Glue Pot Designed to Maintain Automatically the Correct Working Temperature

The glue pot is of cast aluminum with the rim machined to give an air-tight fit on the water pot, in order to prevent loss by evaporation. A drip ring returns all condensation to the water pot. The water jacket is a gray iron casting, ground to an air-tight fit with the glue pot. The outside of the water pot telescopes over a rim on the base, preventing any penetration of water to the heating element when refilling the pot. The necessity for replenishing the water occurs only at long intervals. By actual test, these glue pots have operated for three weeks before additional water had to be supplied.

The heating element consists of a nichrome ribbon, insulated by mica plates, and is moisture proof. Easy replacement of the heating element or of the automatic control is made possible by the simplicity of its construction. The crowned base presses the heating element solidly against the bottom of the water pot, to insure a perfect thermal contact. An asbestos plate and air chamber in the base adds to the heat insulation and tends to prevent any loss by radiation downward. The current consumption is low and the device is economical to operate.

The thermostatic control provides positive heat control that will hold the temperature of the contents of the glue pot at 150 deg. F., with a variation of less than 5 deg., regardless of room temperature. The thermostat is set at this point and is fully tested before the glue pot leaves the factory.

The device can be operated from an ordinary electric light socket, and it is equipped with a cable and separable plug. Its simple construction is shown by the cut away portion of the water jacket.

Alemite Lubricating System for Rods

THE Alemite lubricating system, developed by the Bassick Manufacturing Company, Chicago, has recently been extended to the lubrication of locomotive rod bearings, and is now being tried with considerable success on several roads. Briefly, the system consists of a large Alemite grease gun (Fig. 1) which can be quickly applied without threading over the end of a nipple (Fig. 2), the latter taking the place of the ordinary rod grease cup plug or cap. These nipples are turned into the grease cups and spot welded in place so that there is no possibility of their working out and becoming lost, a considerable item of expense in ordinary locomotive operation due to the actual cost of the caps which work off and, perhaps more serious, the opportunity thereby afforded for dirt and grit to get into the grease. The third element of the Alemite system as applied to locomotive rods is the smaller grease gun (Fig. 3) carried by each engineman to apply grease to the rod bearings as needed while on the road.

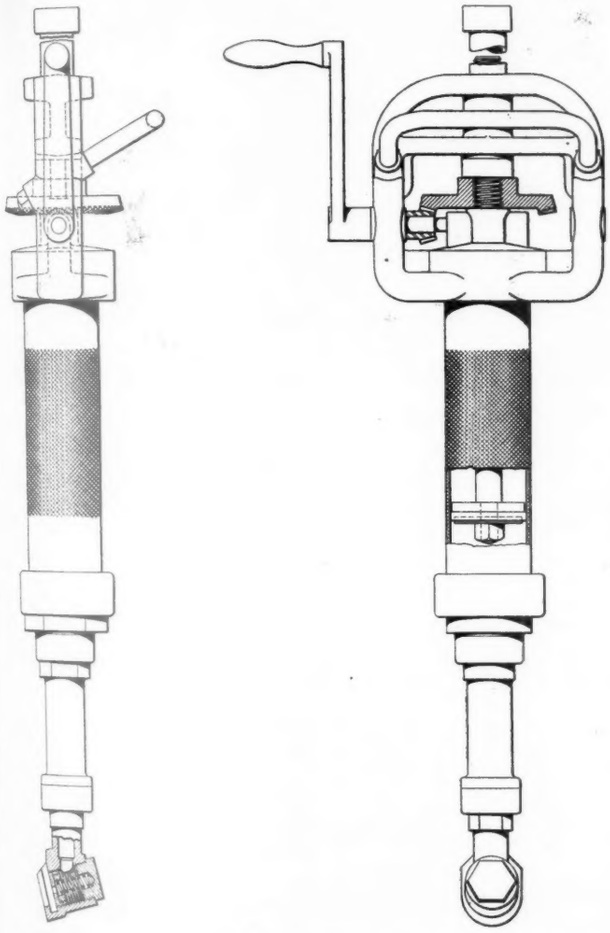


Fig. 1—The Large Alemite Grease Gun Used to Fill Rod Cups

In operation, the rod grease cups are filled at the roundhouse before starting a trip with the large gun illustrated in Fig. 1. The arrangement of this gun to fit over the end of the nipple is apparent, as is also the powerful gearing arrangement for forcing hard grease through the ¼-in. hole into the grease cup. Pressures up to 2,500 lb. per sq. in. are said to be obtained by turning the long handle which moves the piston through a threaded spindle and gearing arrangement. Friction on the large gear is greatly reduced by means of the ball thrust bearing illustrated. The leather L and spring S in the end of the gun are so designed as to take care of slight irregularities in the nipple ends and prevent the leakage of grease when the gun is first applied. After pressure is developed in the gun, the leather is held against the nipple with a heavy pressure and no grease can be forced out except to the grease cup.

Referring to Fig. 2, which shows the nipple, A is the shoulder over which the grease gun fitting is applied. The valve B and spring S are so arranged that hard grease can enter the nipple, but as soon as the pressure is relieved the valve seats and prevents the entrance of dirt or other foreign matter.

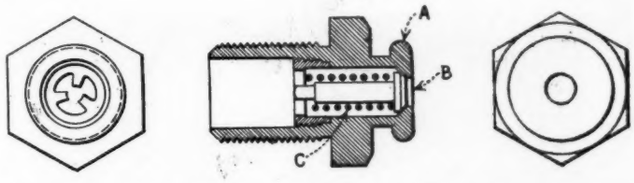


Fig. 2—The Nipple Which Replaces the Ordinary Grease Cup Plug or Cap

Probably the main advantage of the Alemite lubricating system as applied to locomotive rods is in the better lubrication provided. With reasonable care in filling the gun, clean grease can be applied to the rod bearings with no danger of cinders, dust and dirt being included as is too often the case under present methods. Enginehouse men assigned to the duty of filling rod grease cups do not always realize the importance of keeping the grease clean, and even with the best of intentions under present methods the cylindrical sticks of grease often contain more or less dirt picked up when they are laid on the rods or possibly fall to the ground. The Alemite system is designed to prevent foreign matter getting into the grease and eventually to the rod bearings in this manner and hence tends to improve the efficiency of rod lubrication and prevent cut and hot bearings.

The prevention of lost grease cup plugs and caps is an important advantage as is also the considerable saving in time effected by the Alemite system, both in filling grease cups at the enginehouse and in applying grease to the bearings as needed on the road. The grease gun fitting is simply applied over the end of the nipple and a few turns of the handle will do the work, whereas the older method requires that the plug or cap be threaded into and out of the grease cup possibly several times before sufficient grease can be forced in to fill the cup.

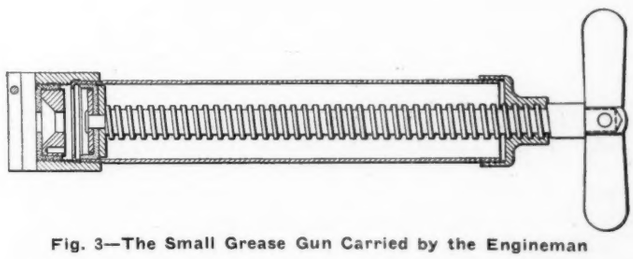


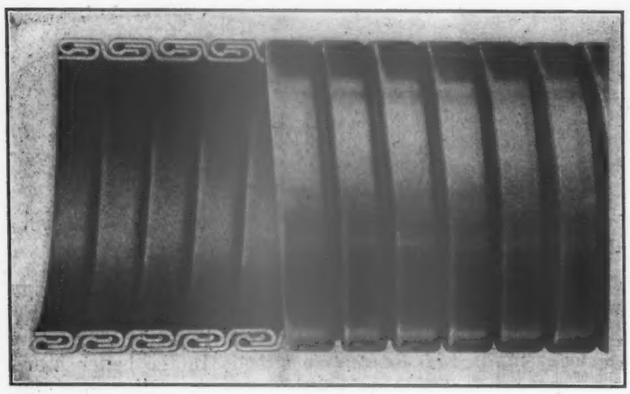
Fig. 3—The Small Grease Gun Carried by the Engineman

An important safety feature of the Alemite system results from the fact that should a rod bearing become hot, grease can still be forced into it with the grease gun without danger of the engineman being scalded with boiling grease. Serious burns sometimes result when enginemen apply grease to a hot bearing and attempt to thread the plug or cap back into the cup by hand.

Flexible Metal Hose Adapted to Railway Use

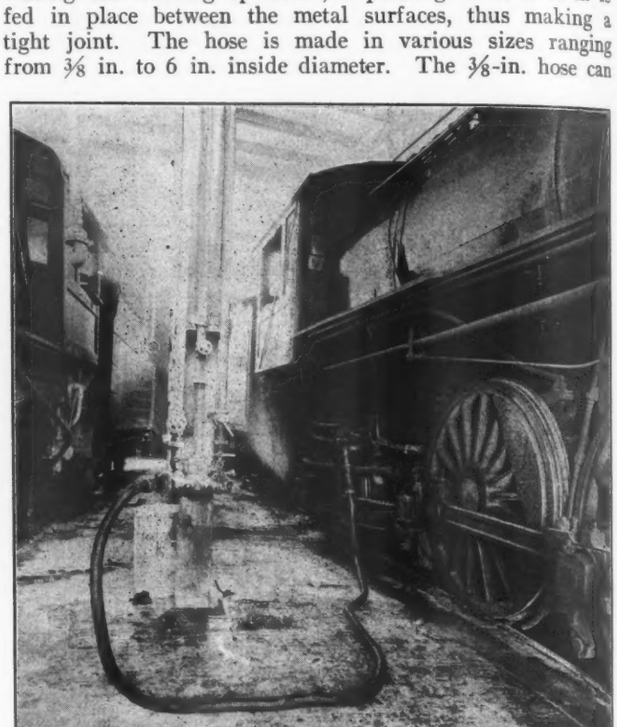
CONSIDERABLE interest is being taken by railroad men in the application of metal hose to railroad requirements. Rubber hose has been used extensively for many purposes, including the conveyance of hot water and steam under pressure. However, when it is used for hot water or steam, the rubber has a tendency to deteriorate rapidly and, as a result, has been the cause of many serious injuries to railroad employees. Unless rubber hose is renewed frequently, its use for such purposes involves an ever present element of danger.

To eliminate such difficulties, the American Metal Hose Company, Waterbury, Conn., has developed a flexible metal hose that is adapted to a wide variety of uses. It is specially adapted to railroad work as a high pressure hose, which may be used for boiler washing, blowing boiler tubes and for general service around enginehouses. It may also be used for such work as unloading tank cars, carrying oil and other heavy or inflammable liquids.



Sectional View of Flexible Metal Hose Showing How the Strips Are Interlocked

As shown in the cross-sectional view, the hose is manufactured from a continuous strip of bronze or galvanized steel of high tensile strength. The strip is first profiled to the desired shape and then wound spirally over itself. During the winding operation, a packing in cord form is fed in place between the metal surfaces, thus making a tight joint. The hose is made in various sizes ranging from ⅜ in. to 6 in. inside diameter. The ⅜-in. hose can be bent to form a circle 9 in. in diameter, while the 6-in. hose will form a circle 72 in. in diameter. Two types are manufactured. It requires approximately 1,000 lb. per sq. in. of hydraulic pressure to burst a ¾-in. hose of the lighter type of construction, while the bursting pressure of the same size in the heavier type is 2,500 to 3,000 lb. per sq. in.



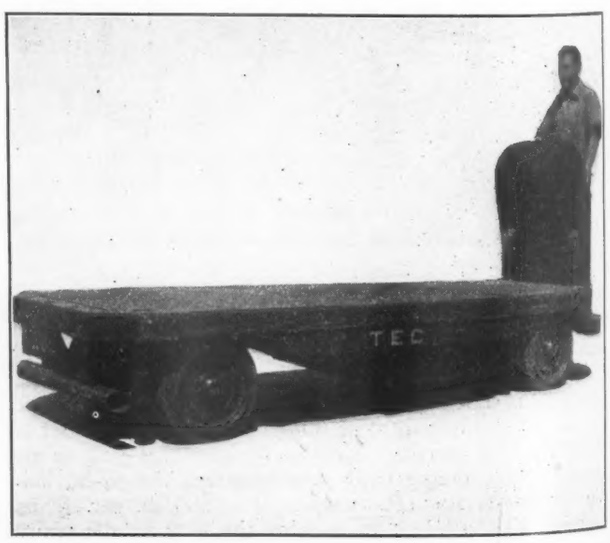
The Hose Is Suitable for Conveying Hot Water or Steam

A Long Wheel Base Truck for Bulky Material

A LONG wheel base truck has been added to the line of the Terminal Engineering Company, Inc., New York. It will carry a load of 5,000 lb. and is intended to handle bulkier goods than can be placed on the shorter wheel base model of the same capacity.

This truck is provided with a drive and handling features identical with those of the shorter models manufactured by this company. It has a four-wheel drive, each wheel being provided with a vehicle type motor enclosed in a weatherproof case. Steering is accomplished with all four wheels, making possible a short turning radius even though the wheel base measures 91 in. The operating controls are so situated that the driver's hands are entirely within the outer edges of the truck, thereby protecting them against injury.

The truck is carried on four full leaf springs and the wheels have 20-in. by 5-in. solid rubber tires. The brakes are of the internal expanding type. Only two of the wheel units are equipped with brakes. However, as they are all alike in general construction, the other two wheels may be provided with brakes if desired. The large wheels, individual drive and springs are intended to permit the use of this truck without having to construct special runways, as it is able to traverse a cinder fill, or run under adverse conditions.



This Truck Is Designed for Carrying Heavy Loads up to 5,000 lb. and Hauling Trailers

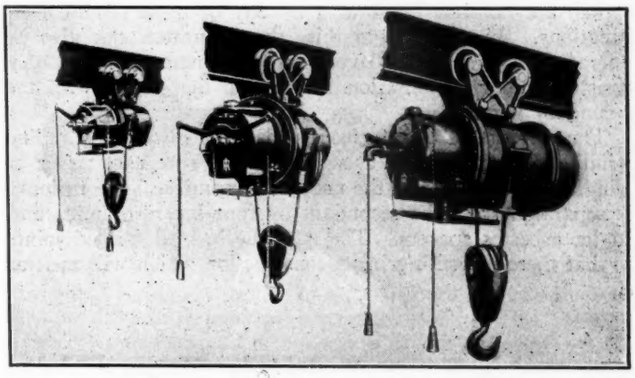
An important feature of this truck is that it is designed to use separable bodies. These bodies are constructed of wood and stand on legs so that they can be picked up by driving the truck under them. The truck is equipped with four screw jacks, one at each corner of the carrying area, that are operated by a motor with the same frame and characteristics as those used on the wheels. It is claimed that these jacks can elevate in five seconds a loaded body from the ground to the full height of 9½ in. The load may be carried in a partially raised position if desired and provision has been made for slippage at both the top and bottom of the jack stroke to avoid jamming.

The truck has a spring drawhead so that it may be used as a tractor if occasion requires. Because the entire weight rests on the driving wheels, the tractive effort is sufficient to move heavy loads, such as spotting freight cars, or hauling large machines and castings on trailers. The coupler is automatic and can be released from the operator's position. Head and tail lights are provided so that the truck may be used at night or indoors where the light is dim.

A Line of Air Motor Hoists in Five Sizes

THE Ingersoll-Rand Company, New York, is now offering a new line of air motor hoists, including five different sizes ranging in capacities from 500 lb. to 10,000 lb. This contains a number of distinctive features and are suited for a wide range of service. The smaller hoist of 500 lb. capacity was described in the November, 1923, number of the *Railway Mechanical Engineer*. The four larger sizes, just developed, are of similar design, except for a few variations in the gearing on the two heavier sizes.

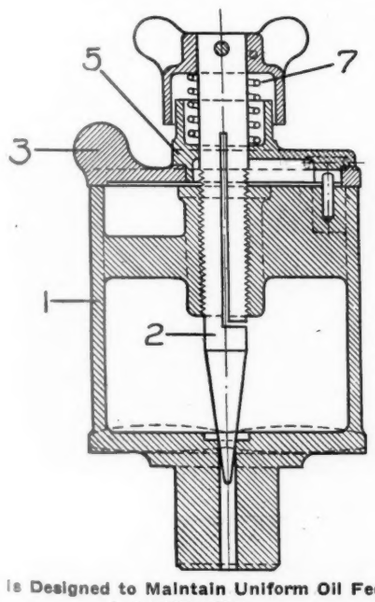
These hoists are compact in design, require little head room and are relatively light in weight. All of the five sizes are equipped with an automatic brake which holds the load positively under all circumstances. Thorough lubrication of all parts has been provided. The motor operates in a bath of oil with passages leading to all bearings, and the gears turn in a heavy grease. The motor and gears are both enclosed. Ball bearings or bronze bushings have been provided at all points necessary to add to the efficiency or life of the hoist. The throttle graduation on these hoists is fine, which ensures instant and complete control of the hoist at any speed. A safety stop lever is provided which closes the throttle when the load reaches the top.



Three Representative Types of Hoists Ranging from 500 lb. to 10,000 lb. Capacity

Oil Cup for Guides and Valve Stems

AN oil cup designed to maintain a uniform oil feed while the engine is in motion, to provide for quick filling, to prevent the loss of the cover and the entrance of dirt into the oil reservoir when the cover is being removed for filling, has recently been introduced by the Nathan Manufacturing Company, New York.



This Oil Cup Is Designed to Maintain Uniform Oil Feed, Unaffected by Vibration

Referring to the drawing, a uniform feed is controlled and maintained by the spindle, 2, much in the usual manner, except that it is made slightly oversize and slotted. This oversize, together with the spring under the winged cap, creates sufficient friction to prevent the spindle from turning due to vibration. This feature assures uniformity of oil feed once the spindle is set.

The method of securing the cover, 3, to the body of the oil cup, facilitates filling. Furthermore, the cover cannot be lost off, nor can dirt get into the oil. The cover can be swung in either direction around the fixed cap, 5, by pressing against the projecting fin on the back. When it is swung away from the closed position a liberal opening is exposed for filling the cup. When the cover is returned to the closed position it is caught by a clip and is positively locked. Liability of losing the cover is practically eliminated as it cannot be removed without first removing the spindle. When opening, it slides over the finished surface of the top of the oil cup body, thus wiping off any dirt that might adhere to it. Malleable iron, instead of brass, is used for the body of the cup because of its lower cost. There is also less likelihood of malleable iron cups being removed from locomotives standing in yards or roundhouses. All parts are made interchangeable, which is an important feature in their maintenance. As shown in the drawing, this oil cup has only seven principal parts that are necessary to maintain. These parts are easily accessible for renewal.

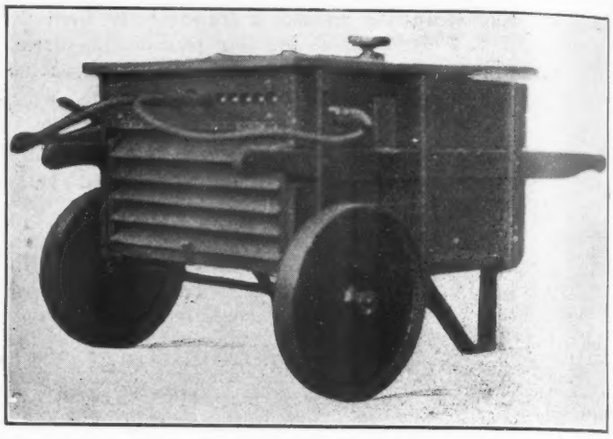
A One-Man Portable Universal Welder

A NEW type of welding transformer has been developed by the Electric Arc Cutting & Welding Company, Newark, N. J. It is called universal because it can be operated from almost any shop supply circuit whether it is alternating or direct current and the manufacturers offer it for doing all kinds of arc welding and also for nickel spotting, lead burning and spot-tack welding.

Previous designs of welding transformers made by this company could be used on alternating current voltages such as 220-440 or 110-220. This unit which is no larger than the regular size can be used on the 110, 220 or 400 volts alternating current by means of multiple, series-multiple and series combinations of the coils of the primary winding. To make the same machine operate on 25 and 40 cycles, taps and adapter windings are used to obtain the proper electrical characteristics. Operation of the blower and automatic switch are not interfered with by any of these circuit combinations. In addition to this, the apparatus can also be operated on 110 and 220 volts direct current by means of a resistor-reactor combination inserted in the circuit with the secondary winding.

The core of the transformer is made of silicon steel. The windings are of double asbestos magnet wire each layer of winding separated from the next by pure mica. The primary is separated from the secondary by four layers of mica and ¼-in. asbestos spacers. The machine has all welded joints so that there is nothing in its construction which will melt or char.

Previous designs of these welders, which weigh about 200 lb. were carried by two men. The machine has now been made easily portable by one man by the addition of wheels at one end and an extension of the side handles at the other so that it can be moved about like a wheel barrow. The machine is furnished either with or without the wheeling arrangement.

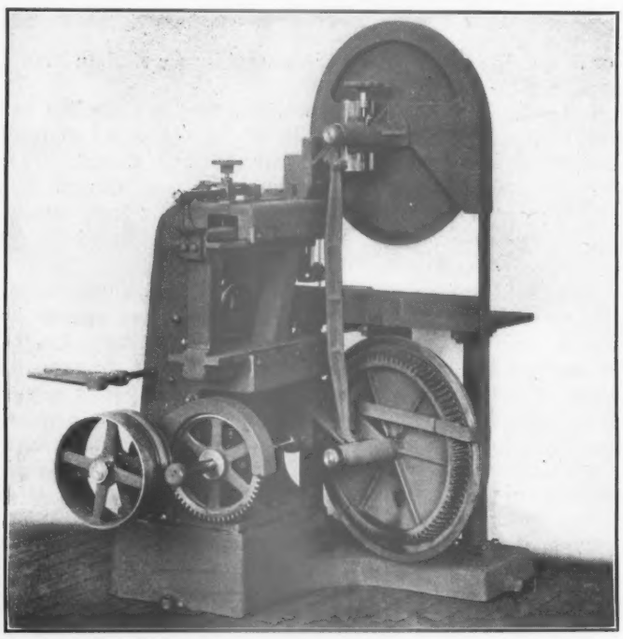


Barrow-Type Universal Arc Welding Machine

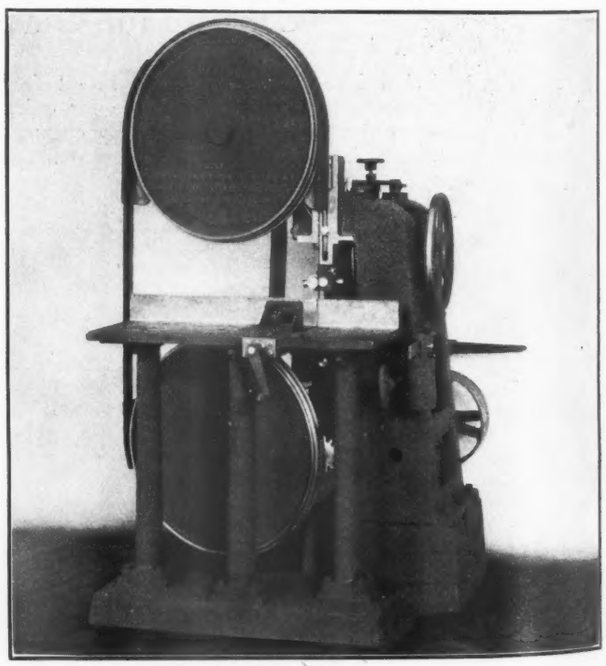
A High Speed Metal Cutting Band Saw

THE Stockbridge Machine Company, Worcester, Mass., has designed a band saw to cut all kinds of metal. The designers have disregarded all previous construction in order to obtain a pressure of the saw teeth against the work that would be subject to fine adjustment and when once set be automatic in its operation.

This machine, known as the H & R high speed metal band saw, consists of a base on which is mounted the column and work table. In the column is a carriage, or ram which slides on scraped ways. Disk wheels for carrying the band are mounted on the carriage, as shown in the illustration, and move with it. The band is carried between two sets of guide rolls directly above and below the work. The top rolls are



Rear View of Machine Showing the Method of Mounting the Disk Wheels



Front View of Metal Cutting Band Saw Showing the Friction Feed Control

adjustable vertically for different sizes of stock and are placed square with the ram. Attached to the ram are weights which move the ram forward and keep the band against the work at a constant pressure.

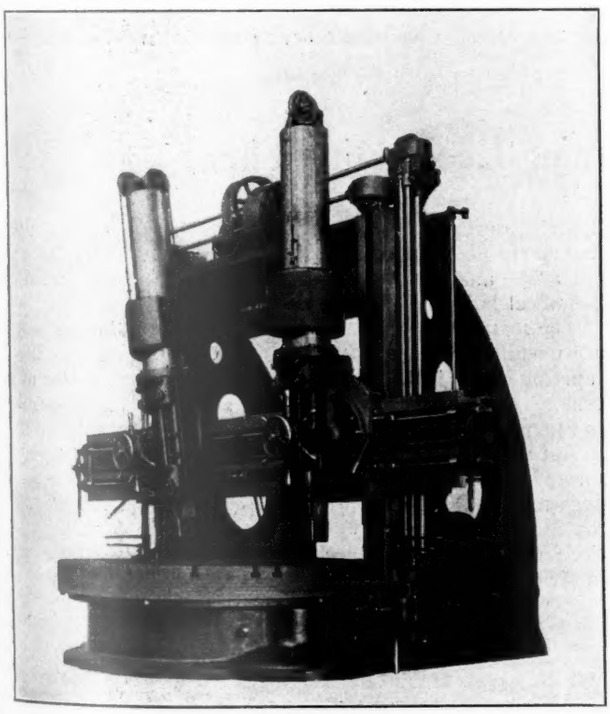
On the side of the column is a wheel which moves through a gear and rack with the movement of the ram. A friction pad rubs against the surface of this wheel and controls, by means of a balancing weight, the feeding of the ram forward as well as the pressure of the band against the work. The position of the weight determines the rate of feed to the ram. A balanced pressure control is obtained without an elaborate mechanism, by means of the pull of the weight on the ram and the friction on the wheel. An automatic stop may be set to stop the feed at any point of the stroke.

The saw is designed for high speed cutting and all parts are made of substantial and rigid construction. Both the fixed and the tension guide rolls are carried on roller bearings and all bearings are provided with dust-proof caps. The guide rolls are hardened and ground. Specially designed self-oiling bearings in the band wheels keep the shaft constantly flooded with oil. A tension screw carried in a pivoted slide, keeps the band taut and in alinement. The saw blades are 1/32 in. in thickness.

The machine can be furnished for either belt or motor drive. It is built in three sizes, cutting either square or round bars up to 6 in., 9 in. and 12 in., respectively.

A 100-in. Double Driven Vertical Boring Mill

A NUMBER of important improvements of special interest have recently been made to the 100-in. double driven vertical boring and turning mill built by the Betts Machine Works of the Consolidated Machine Tool Corporation, Rochester, N. Y. The outstanding feature is that a more powerful drive has been accomplished by means of two spur pinions meshing with an internal gear of wide face and coarse pitch. These double pinions are keyed to the shafts so as to mesh evenly with the table gear. There is a full bearing on both pinions and being located on opposite sides of the gear, a smooth drive is produced. This drive



Betts Vertical Boring Mill with Double Drive

makes the machine particularly applicable to work requiring heavy cuts in steel castings with coarse feeds.

The table, which is of extra thickness, is mounted on a long spindle provided with taper bushings for adjustment of wear at both top and bottom bearings. These bushings are provided with a means for automatic lubrication of the bearings. The saddles and tool spindles have eight feeds which are entirely independent for each side of the machine. The feeds are obtained through sliding steel gears which can be changed instantly from one to another while the machine is running.

The power rapid traverse to the saddles and tool spindles is driven by a motor on top of the machine, which is also used for raising and lowering the crossrail. The arrangement of the power rapid traverse is such that there are no idle running shafts or gears. The top mechanism is not in motion except when the power rapid traverse or crossrail elevation is being used. The feed and power rapid traverse are positively interlocked by a cam arrangement which throws one out before the other is engaged. Both the power rapid traverse and feeds may be engaged, disengaged or reversed directly from the saddles by means of levers located on the operator's side of each saddle. Duplicate stationary levers are provided on each side of the mill for use when the crossrail is in a high position. An interlocking lever is provided at each end of the crossrail for selecting the horizontal or vertical movement. Friction clutches protect the machine against damage and enable all movements to be made rapidly. The crossrail feed screws and elevating screws are provided with roller bearings for taking the thrust. Patented adjusting miters, graduated in thousandths, are carried directly on each saddle in a convenient location for the operator while making final hand adjustments for positioning the tools both horizontally and vertically.

The tool spindles are counterbalanced by means of ring type counterweights, designed to operate at all angles. This arrangement eliminates cumbersome overhanging chains and sheaves and greatly improves the appearance of the machine. The tool spindles also have a friction locking device for operating the rack pinion, which allows the operator to raise or lower the spindle quickly by hand.

The crossrail has a wide facing which is provided with a narrow guide and its construction is carried back between the uprights in order to give sufficient stiffness when the heads are near the center. It is clamped to the upright flanges at both the inside and outside, making the whole machine practically one solid unit.

The driving motor is geared direct to the speed box. On alternating current driven machines, the speed box provides 12 table speeds in geometric progression through hardened steel sliding gears. This drive is furnished together with a friction clutch and brake for starting and stopping the machine from either side, independent of the motor.

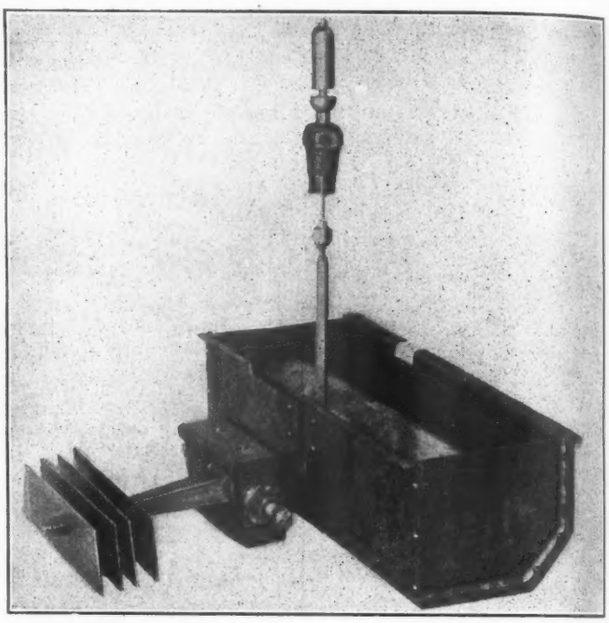
Machines with direct current motors have three mechanical speed changes which, in connection with a 3 to 1 adjustable speed motor, gives a total speed range of 27 to 1. A field rheostat and dynamic brake in the motor controller, operated in connection with a push button control, provides a means for instantly stopping or changing the speed as the operator may desire.

Low Water Alarm of the Float Type

A NEW low water alarm, differing in principle from other devices of this character, is being manufactured by the United States Metallic Packing Company, Philadelphia, Pa. This device, known as the Security low water alarm, employs no fusible plugs of any kind, but is actuated solely by the height of solid water over the crown sheet.

A cylindrical buoyant float is secured to the end of the rocker arm shown in the illustration. This rocker arm is pivoted in a bracket so that the float rises and falls with the variation of the water level in the locomotive boiler. The bracket which supports the rocker arm is located so that the center of the pivots is five inches above the crown sheet. When the water in the boiler is five inches above the crown sheet, the float causes the needle on the end of the vertical rod to seat in the whistle and the float can rise no higher above the crown sheet. When the water in the boiler is reduced to a height less than five inches above the crown sheet the float, now resting on the surface, will fall as the level of the water in the boiler becomes lower. The weight of the float pulls the needle valve away from the seat in the whistle and this sounds a warning, calling the engineer's attention to the low water condition.

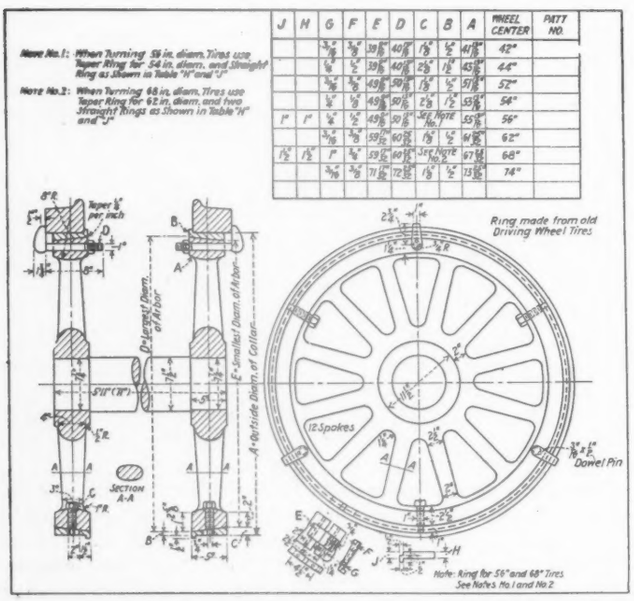
The cylindrical float which controls the sounding of the whistle is encased in a sheet iron baffle box. The purpose of this baffle box is to break up any surging or pyramiding of the water so that the whistle will not sound unless there is an actual condition of low water. Secured to the balance lever on the opposite side from the cylindrical float is a series of plates. These plates present the same surface area for corrosion as is presented by the cylindrical float. Any corrosion or scale formation is thus equalized on both ends of the rocker arm.



This Alarm Is Actuated Solely by the Height of the Water

Expanding Arbor for Turning Locomotive Tires

WITH the purpose of overcoming some of the difficulties encountered in turning unmounted tires, E. J. Brewster, Chicago, Ill., has patented an expanding arbor, the details of which are shown in the drawing. It is claimed that this device eliminates the necessity for heating the tires, first to shrink them on the wheel centers used for the turning operation, and then to remove them after they are turned on the wheel lathe.



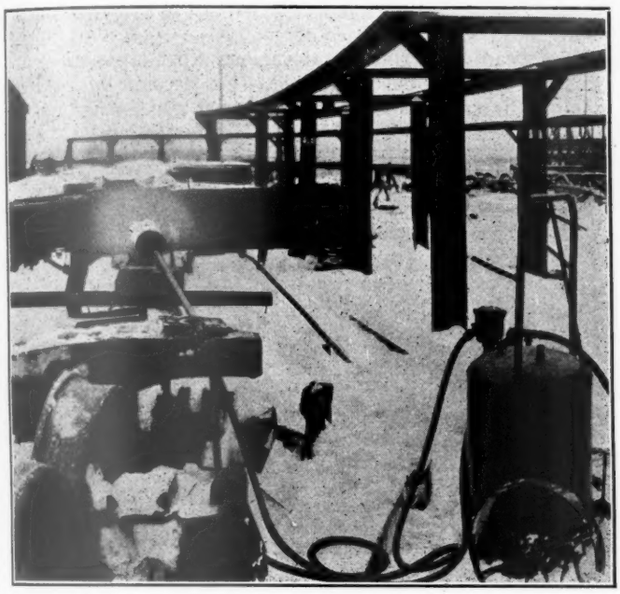
An Expanding Mandrel for Holding Unmounted Tires While Being Turned

The main center of the arbor is shown at *A*, two of which are mounted on the shaft or axle. A split band *B* is bored tapering on the inside to fit a corresponding taper on the main center. This band is provided with a shoulder against which to line up the tire and it may be made in different thicknesses to suit different sizes of tires. Retaining screws *C* are placed through the rim and project into slotted holes in the band to keep it from falling off in case the centers are being handled without tires on them. The bolts *D* are used to tighten the tire on the arbor. The block *E*, is provided to keep the band in shape sideways and is used only on thin bands. It is inserted under the tire at the point where the band is cut. The block has a slotted hole in order to hold the band in line as well as to allow it to expand. When the bands are expanded and the wheels are put in the lathe, the tendency of the drivers is to tighten the tire on the centers. This allows the operator to take cuts up to the capacity of the machine. After the tires are turned, all that is necessary is to remove them from the lathe, loosen the bolts *D*, and strike the tire on the inside with a sledge.

It is claimed that the expanding arbors will hold a set of tires even though the inside bore should vary as much as ¼ in. in diameter, and that this device will insure round tires, eliminating the possibility of getting too much strain on them, as is apt to occur while shrinking them on arbors which require excessive shimming. It is difficult to mount wheels by shimming and there is also possibility of a poor fit.

An Oil-Burning Torch Equipped with Vacuum Atomizer

THE Johnston Manufacturing Company, Minneapolis, Minn., has improved the nozzle on its high lift vacuum car repair torch, described in the December number of the *Railway Mechanical Engineer*. The apparatus includes two nozzles. The smaller one is made of cast iron and the larger one of cast steel in order to insure lightness and at the same time hold its shape while in service. Both sizes are now equipped with an atomizer located in the torch head and inside the nozzle. It is designed to eliminate any sensitiveness of the flame to motion or jarring and also to give a dependable vacuum at extreme high lifts. The continuity of the flame is not dependent on a hot nozzle or any other means outside of the atomizer itself. The expansion of the atomizing air produces a partial vacuum by which the oil is drawn from the tank. Tests have shown that it has the ability to operate at high lifts and has sufficient excess capacity and dependability for operation under extreme conditions, such as cold weather, rain, snow, or wind.



High Lift Vacuum Torch Designed to Operate Under Adverse Conditions

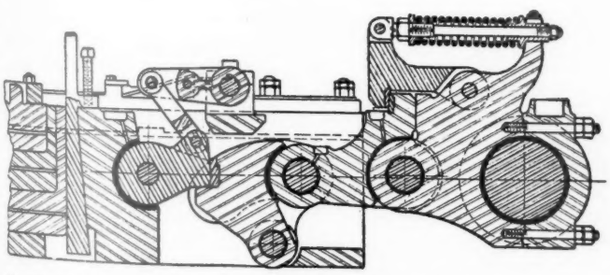
The air pipe, made of ¾-in. standard wrought iron pipe, constitutes the torch handle. This is screwed into the torch head at one end and into the air cock body at the other. The oil pipe is inside the air pipe where it is fully protected. It may also be repaired easily with the facilities available in any shop in case the torch should meet with a serious accident.

The air is controlled by a spring loaded air cock. The oil is controlled by a needle valve of such construction that it will not stick and become inoperable due to the effect of heat. The hose is attached to the fittings with compression coupling nuts that give a smooth external surface. A special compound is used for applying the hose to the couplings in order to preserve the rubber lining of the hose and complete a connection as strong as the hose itself. The hose connections to the tank are made by substantial brass unions that may be tightened by any small wrench.

A Rocker Type Drop Lock for Forging Machine

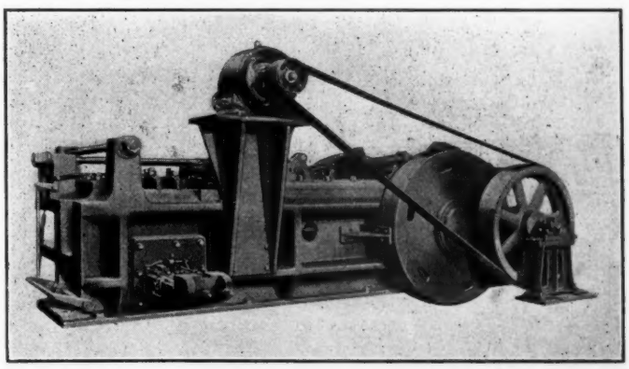
A NEW stop motion device called the rocker type drop lock, has been developed recently by the Ajax Manufacturing Company, Cleveland, Ohio, for its new model bolt heading upsetting forging machines.

The operation of the lock is somewhat similar to a press; that is, the slides remain at rest until the hot stock is located in the impression in the stationary die and the machine is tripped. The usual method, in machines controlled by the operation bringing the slides into action, is by engaging a hub clutch in a revolving gear or flywheel directly into the end of the crank shaft while it is at rest. As this requires the sudden picking up of the crank shaft to full speed, a severe shock cannot be avoided when such heavy parts are involved.



Sectional View Showing the Drop Lock Engaged with the Rocker Pitman and Crankshaft

The drop lock device has been designed to provide an entirely different action. The crank shaft, with the pitman attached, is in idle rotation when the slides are at rest. The wrist pin end of the pitman is carried by an oscillating rocker fulcrumed at the bottom of the header slide, and while the machine is idle this rocker swings free under the drop lock, as shown in the drawing. When the treadle is depressed, the lock drops onto the upper surface of the rocker and rides on this surface until the rocker reaches its extreme back travel where the lock is engaged. This engagement occurs, just as the crank shaft passes over its back dead center. The velocity of the reciprocating and oscillating parts is practically zero when engaged and the slides are thrown into motion without shock for as many strokes as desired. Upon the operator removing his foot from the



The Ajax New Model Bolt Heading Upsetting Forging Machine

treadle, the lock is disengaged and the slides come to rest at their extreme back travel.

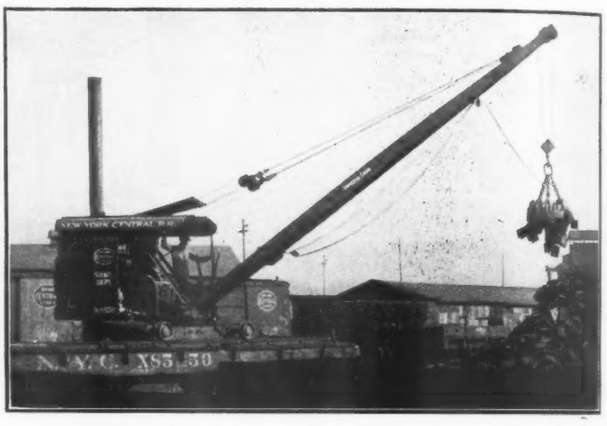
This device is similar in principle to the slide block type of drop lock formerly used on the same machine, but is an improvement over the old design, because of the extreme shortness of the lock, the increased engaging area and its smooth action. Its relatively light weight eliminates the counterweight and timing lock formerly employed.

A Crane for General Railroad Service

THE Universal Crane Company, Cleveland, Ohio, is manufacturing a light crane that is adapted to various types of mountings. The illustration shows a crane of the traveling type mounted on a standard flat car. The track on which the crane operates has a 6-ft. 6-in. gage and it may be easily extended from one car to another by laying additional sections. The crane can propel itself over a train of flat cars, as the material is handled. A mechanical locking device permits it to operate without fouling adjacent tracks while swinging. This crane may also be permanently mounted on the car and geared to the truck axle for work around shops where a locomotive is not required. The travel gear can be quickly disconnected.

The crane may be driven by either a four-cylinder heavy duty gasoline motor, or an electric motor. The use of either drive tends to reduce operating costs, as hostling is unnecessary, there is no time lost in getting up steam or taking water, there is no expense due to boiler maintenance and fuel is consumed only during actual operation. It is designed for one-man operation, and considerable attention has been paid in facilitating ease and rapidity of handling. All parts are made standard and interchangeable.

The ordinary equipment has a 28-ft. boom, so that the entire unit can be carried on one flat car. If specified, the crane can be built to handle a clam shell or drag line bucket. A generator to supply current for a magnet, hoist block, capstan head, niggerhead and various other types of equipment can be supplied if desired. On account of its light weight, this crane is adapted to special gage mountings on bins or trestles. It also has the added advantage of adaptability to motor trucks and trailers and can be easily transferred from one mounting to another.



Universal Crane That Can Be Adapted to Various Mountings

Gasoline-Driven Tractor for Railroad Use

A GASOLINE-DRIVEN tractor, built to stand the rough usage and service to which such a machine is generally subjected in the handling of freight, merchandise and baggage on warehouse, freight station and depot platforms, has been developed by the Omaha Steel Works, Omaha, Neb. This tractor is also well adapted to the transportation of materials, parts and tools in and about store rooms, back shops and enginehouses. The design and shape of the tractor platform can be varied to suit conditions, or a box body can be furnished when desired.

The Gasoline Tractor in Use

The power plant in the new tractor which is called the Omsteel is a Ford motor and transmission mounted on its own frame inside of and under the main frame of the tractor. This feature and the arrangement of axles and springs provides a double three-point suspension. A suitable pump is designed to assure positive water circulation. A Ford torque tube, drive shaft and rear axle are used for the drive, hardened, finished roller chains operating on cut steel sprockets, connecting the Ford driving unit and the rear wheels of the tractor. Radius rods provide for play of the springs and permit ample chain adjustment. A heavy, well braced steel plate and angle fender and bumper on the front of the tractor makes it possible to use the tractor for pushing as well as pulling.

The steel coupler is bell-mouthed and can be operated by the driver enabling him to couple or uncouple trailers from his position. The coupler is built for the standard Omsteel trailer equipment but can also be made to meet any required specifications.

In the trailer design the four wheels are mounted on steering knuckles connected to the drawbar so that the steering is accomplished by all four wheels. The wheels run on roller bearings, thereby greatly increasing the number of trailers which can be handled by one tractor. The trailers are relatively light in weight and can be shifted by hand.

GENERAL NEWS

The safety banner awarded annually by the Union Pacific to its shops showing the lowest accident record was awarded for 1923 to the shopmen at Denver, Colo., on March 13. Only 10 personal injuries occurred at these shops during 1923.

The shops of the Baltimore & Ohio at Parkersburg, W. Va., known as the "low yard" shops, have been abandoned, the high and low yard shops at that point having recently been merged at a contemplated saving of $40,000 a month. About 150 men have been laid off as a result of this consolidation.

The Chilean State Railways have recently published a list of materials needed for railway operation in 1924, on which bids are asked, according to Commerce Reports. The list includes a group of repair parts for locomotives, cars, and coaches, amounting to about 3,882,000 pesos (approximately $388,200 at current exchange).

Division officers from all divisions of the Chicago, Burlington & Quincy met at Omaha, Nebr., on March 20 to form committees for an economy campaign. Committees were formed for each division, each consisting of the division superintendent as chairman and division officers of the engineering, mechanical and stores departments as members.

The roundhouse of the Pennsylvania at Oil City, Pa., known as the North Side shops, was recently destroyed by fire. The building, a nine-stall, semi-circular frame structure, was burned to the ground. Ten locomotives, three of which were ready to be moved after receiving light repairs, were damaged to the extent of about $25,000. An investigation by Supt. J. J. Rhoades brought out the fact that a lighted torch left near a wooden locker in the south corner of the building was the cause of the fire.

The Reading Company has recently awarded a contract to the Baldwin Locomotive Works for the construction of five Pacific type locomotives similar to those now in use in New York service on its seashore and main lines. These locomotives will be built at Eddystone and will be delivered by June 1, 1924. When the locomotives will have been placed in service, the Reading Company will have 30 of this type in use over its lines. Each of the locomotives stands 15 ft. high on the rails and measures in length overall 79 ft. 6 in. The driving wheels are 6 ft. 8 in. in diameter. The weight of the engine and tender is 450,000 lb. and the tractive force is 40,900 lb.

Brotherhood Proposes to Get Rid of Labor Board

D. B. Robertson, president of the Brotherhood of Locomotive Firemen & Enginemen, has announced that the three Cleveland brotherhood presidents are supporting a bill to be introduced concurrently in the Senate and the House of Representatives at Washington, entitled "The Railway Labor Act," abolishing the United States Railroad Labor Board. The proposed act embodies some of the features of the present laws intended to preserve peace in the transportation industry, Mr. Robertson said. The basis of the bill is an obligation to negotiate agreements and to abide by such voluntary contracts.

Canadian Government Car Inspections

The number of cars inspected by the Dominion Board of Railway Commissioners in 1923 was 77,345, of which 3,458, or 4.47 per cent, were found defective. The grand total of defects was 3,811, of which 80 were in couplers and parts, 619 in uncoupling mechanism, 164 handholds and 2,007 air brakes.

Germany's Locomotive Exports Decrease

Exports of steam railway locomotives from Germany during the first nine months of 1923, according to Vice-Consul Magnuson at Stuttgart, were about 82 per cent less than in the corresponding period of 1922, locomotives decreasing from 1,321 with a weight of 64,768 metric tons to 482 with a weight of 11,928 tons; exports of tenders dropped from 846 to 109. The chief reason for this decline is the fact that Russia, which had been Germany's best customer in 1922, reduced its purchases from Germany in 1923 to a minimum. Rumanian imports of German locomotives also fell off considerably, as did those of all of the countries near Germany except East Poland.

Personnel of Bolt, Nut and Rivet Committee Appointed

The American Engineering Standards Committee has appointed a committee to develop standards for bolt, nut and rivet proportions. This work is being sponsored by the Society of Automotive Engineers and the American Society of Mechanical Engineers. This committee consists of 43 members, 17 of whom represent producers, 24 consumers, and 2 general interests. It is divided into eight sub-committees, dealing with the following specific subjects: large and small rivets, wrench head bolts and nuts, slotted head products, track bolts and nuts, carriage bolts, special bolts and nuts for agricultural machinery, body dimensions and material, and nomenclature.

Defective Locomotives in February

The number of locomotives inspected by the Bureau of Locomotive Inspection of the Interstate Commerce Commission during February was 5,631, according to the commission's monthly report to Congress on the condition of railroad equipment. Of these 3,064 were found defective and 577 were ordered out of service. The number of accidents caused by the failure of some part or

LOCOMOTIVE AND FREIGHT CAR REPAIR SITUATION

	Locomotives					Freight cars					
Date 1923	No. locomotives on line	No. serviceable	No. stored serviceable	No. req. repairs over 24 hr.	Per cent req. repairs over 24 hr.	Date 1923	No. freight cars on line	Cars awaiting heavy repairs	Cars awaiting light repairs	Total cars awaiting repairs	Per cent of cars awaiting repairs
January 1	64,453	48,905	576	13,587	21.1	January 1	2,264,593	164,041	51,970	216,011	9.5
April 1	64,559	50,107	914	12,801	19.8	April 1	2,296,997	154,302	52,010	206,312	9.0
July 1	63,906	52,456	2,181	10,326	16.2	July 1	2,260,532	146,299	44,112	190,411	8.4
October 1	63,982	54,159	2,620	8,787	13.7	October 1	2,270,840	118,563	32,769	151,332	6.7
November 1	64,192	54,080	2,517	9,163	14.3	November 1	2,263,099	116,084	34,540	150,624	6.6
December 1	64,336	53,764	3,367	9,577	14.9	December 1	2,270,405	116,697	38,929	155,626	6.8
1924						1924					
January 1	64,406	54,031	5,061	9,395	14.6	January 1	2,279,363	118,653	39,522	158,175	6.9
						February 1	2,269,230	115,831	45,738	161,569	7.1
						March 1	2,262,254	119,505	49,277	168,782	7.5

LOCOMOTIVE REPAIR SITUATION—NEW METHOD OF COMPILATION

Date	No. locomotives on line	No. serviceable	No. stored serviceable	No. req. classified repairs	Per cent	No. req. running repairs	Per cent	Total req. repairs	Per cent
February 1	64,377	53,586	4,116	5,919	9.2	4,872	7.6	10,791	16.8
March 1	64,431	53,127	3,800	6,047	9.4	5,257	8.1	11,304	17.5

appurtenance of the locomotive or tender was 92, in which 11 were killed and 99 injured. During the same month 87,965 freight cars were inspected, of which 3.8 per cent were found defective, and 1,481 passenger cars, of which 11 or .7 per cent were found defective. Fifteen cases involving 28 violations of the safety appliance acts were transmitted to various United States attorneys for prosecution.

Wage Statistics for December

The average number of employees of Class I railroads during the month of December, 1923, was 1,793,779, an increase of 5,189, or 0.3 per cent over the number reported for December, 1922, according to the monthly bulletin of wage statistics issued by the Interstate Commerce Commission. However, owing chiefly to the comparatively excessive overtime payments in December, 1922, there was a decrease in the total compensation of $13,010,507, or 5.3 per cent. The returns for December, 1923, compared with those for the preceding month, show a decrease in the number of employees of 105,766, or 5.6 per cent, which appears principally in the maintenance groups. Total compensation decreased $15,024,016, or 6.0 per cent.

A comparison of the cumulative returns for the twelve months, 1922 and 1923, shows an increase in 1923 of 14.3 per cent in employment, and of 14.0 per cent in total compensation.

Court Decisions

Strike No Defense to Charges of Violating Safety Appliance Act.—The Circuit Court of Appeals, Ninth Circuit, holds that an emergency caused by a strike is no defense to a charge of violation of the federal Safety Appliance Act. A railroad which receives a car in a defective condition from another carrier is forbidden to haul it over its lines any distance, for any purpose, unless it is a mere incidental movement, to reach other cars on the exchange track. Where the evidence as to defect in the car conflicted, the question of existence of the defect was held for the jury.—United States v. Northern Pacific, 293 Pac. 657.

Second Action for Violation of Boiler Inspection Act Barred.—The Circuit Court of Appeals, Ninth Circuit, holds that a judgment for the railroad in an action for personal injury due to its alleged failure to comply with the regulations adopted under the Boiler Inspection Act in a specified respect (that the cab apron was not roughened and was not level with the tender floor), is a bar to a subsequent action for the same injury, where failure to comply with a different requirement of the regulations (that the apron was too short at each end, making the gangway between locomotive and tender insufficient in width) was alleged to have caused the injury.—Miller v. Spokane International, 293 Fed. 748.

Wages

The shop crafts employees on the Southern Railway have filed with the management of the road a request for wage increases. The increase asked is four cents an hour.

The railway employees' department of the American Federation of Labor is about to demand wage increases of 4 cents an hour for the shopmen it represents, according to a report from Chicago. The fact that the shopmen have asked such an increase on the Southern and the Mobile & Ohio is considered as an indication of a concerted drive for general increases.

LOCOMOTIVES INSTALLED AND RETIRED

Month 1923	Installed during month	Aggregate tractive effort	Retired during month	Aggregate tractive effort	Owned at end of month	Aggregate tractive effort
Sept. ...	384	22,342,517	260	7,191,302	64,720	2,506,469,051
Oct. ...	408	21,665,487	301	7,935,709	64,827	2,520,200,846
Nov. ...	333	19,054,713	282	7,741,395	64,879	2,532,085,380
Dec. ...	333	18,260,423	316	8,738,378	64,896	2,541,607,425
1924						
Jan. ...	271	15,228,895	178	4,447,721	64,989	2,552,694,953
Feb. ...	214	.....	175	.....	65,029	.....
March .	...	.....	...	.....	.....	.....

Figures prepared by Car Service Division, A. R. A., published prior to October in reports relative to progress, made on A. R. A. transportation program, and more recently in greater detail given in form C. S. 56A-1. Figures cover only those roads reporting to the Car Service Division. They include equipment received from builders and railroad shops. Figures of installations and retirements alike include also equipment rebuilt to an extent sufficiently so that under the accounting rules it must be retired and entered in the equipment statement as new equipment.

Employees in the shops of the American Locomotive Company at Dunkirk, N. Y., have accepted a reduction in wages of about 10 per cent, the request of the company having been made on the basis of the argument that without such a reduction certain orders for work could not be secured. As the result of the agreement these shops are to build 25 locomotives for the Union Pacific and 24 for the Louisville & Nashville. The shopmen have requested local merchants and physicians to reduce their prices to correspond with the prospective reduction in the incomes of the petitioners.

Negotiations for the upward revision of wage schedules to the 1920 level have been reopened between a committee representing the station, shop, shed, roundhouse, clerical and other employees and a committee representing the management of the Canadian National Railways. The average increase over the present wages sought by the men is 12½ per cent. Negotiations are being conducted in Montreal. Notice was given last summer by the employees that they desired a revision of the wage schedule and of working conditions and their committee met a committee of the C. N. R. management, under A. E. Crilly, chief of the wage bureau. Activities were suspended pending the convention of the Canadian Brotherhood of Railway Employees.

General Electric Company to Run Important Tests

Operating officials from a number of important steam railroad systems are co-operating with the General Electric Company in conducting operating tests with locomotives to determine the limits of adhesion during acceleration and running with various train weights and different conditions of rail.

The otheograph, demonstrated last December at the Erie Works of the General Electric Company, will play an important part in the tests.

The equipment used will be a Mikado type freight locomotive No. 74, furnished by the New York Central Railroad; one of the new Mexican locomotives, recently completed at the Erie works of the General Electric, and a G-E experimental locomotive No. 18.

The trailing train used with the above locomotives in turn will be made up of a dynometer car, 10 loaded coal cars and a coach giving a total weight of approximately 1,000 tons.

Another train will consist of the dynometer car, five coal cars and a coach, approximately 600 tons.

The tests will be repeated on a dry rail, a dry rail sanded, wet rail, and wet rail sanded.

MEETINGS AND CONVENTIONS

The Chief Interchange Car Inspectors' and Car Foremen's Association will hold its next regular annual meeting at the Sherman hotel, Chicago, on September 16, 17 and 18.

Pacific Railway Club Elects Officers

At its seventh annual meeting held at the Hotel Oakland, Oakland, Cal., March 13, 1924, the Pacific Railway Club elected the following officers to serve during the coming year: President, H. A. Mitchell, vice-president and general manager of the San Francisco-Sacramento Railroad; first vice-president, J. W. Williams, chief engineer, Western Pacific; second vice-president, A. S. McKelligon, general storekeeper, Southern Pacific; treasurer, R. G. Harmon, chief clerk, Denver & Rio Grande-Western Pacific; secretary, William S. Wollner, general safety agent, Northwestern Pacific.

Cleveland Steam Railway Club

The car men of Cleveland, Ohio, and vicinity have organized the Cleveland Steam Railway Club, with meetings to be held the first Monday of each month at the Hotel Cleveland, Public Square, Cleveland. The officers of the club are as follows: President, T. O. Quinn, general car foreman, Big Four, Cleveland; first vice-president, L. J. Collins, general foreman, New York Central, Nottingham, Ohio; second vice-president, G. L. Foster, assistant chief joint inspector, Cleveland; secretary-treasurer, F. L. Fericks, car foreman, New York Central, Cleveland. Executive committee: T. J. Bell, car foreman, Erie Railroad, Cleveland; G. L. Staley, steel car foreman, Big Four, Cleveland; H. E. Kirkwood, car foreman, Baltimore & Ohio, Cleveland. The club was

organized for the purpose of discussing subjects of interest to car department employees. It is the intention to invite prominent railway officials to address the club on some live subject at each meeting. 285 members are enrolled. At the first regular meeting on Monday evening, March 3, at which 182 members were present, E. A. Jackson, supervisor of inspectors of the Big Four at Indianapolis, Ind., presented a paper on the preparation of record repair cards, and writing and checking repair bills.

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations and railroad clubs:

AIR-BRAKE ASSOCIATION.—F. M. Nellis, Room 3014, 165 Broadway, New York City. Next meeting Mt. Royal Hotel, Montreal, May 2-5.

AMMERICAN RAILROAD MASTER TINNERS', COPPERSMITHS' AND PIPEFITTERS' ASSOCIATION.—C. Borcherdt, 202 North Hamlin Ave., Chicago.

AMERICAN RAILWAY ASSOCIATION, DIVISION V.—MECHANICAL.—V. R. Hawthorne, 431 South Dearborn St., Chicago. Convention June 11-18. 1924, Atlantic City, N. J.

DIVISION V.—EQUIPMENT PAINTING DIVISION.—V. R. Hawthorne, Chicago.

DIVISION VI.—PURCHASES AND STORES.—W. J. Farrell, 30 Vesey St., New York. Convention June 16-18, 1924, Atlantic City, N. J.

AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—J. A. Duca, tool foreman, C. R. I. & P., Shawnee, Okla. Annual convention August 28-30, Hotel Sherman, Chicago.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. Thirty-ninth St., New York. Railroad Division, A. F. Stuebing, 23 West Forty-third St., New York.

AMERICAN SOCIETY FOR STEEL TREATING.—W. H. Eiseman, 4600 Prospect Ave., Cleveland, Ohio. Next meeting September 22-26, inclusive, at Boston, Mass.

AMERICAN SOCIETY FOR TESTING MATERIALS.—C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.—Joseph A. Andreucetti. C. & N. W., Room 411, C. & N. W. Station, Chicago, Ill.

CANADIAN RAILWAY CLUB.—W. A. Booth, 53 Rushbrook St., Montreal, Que., Regular meetings second Tuesday in each month, except June, July and August, at Windsor Hotel, Montreal, Que. Next meeting April 8. A paper on Handling of Mail will be read by V. Gandet, postmaster, City of Montreal.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—Aaron Kline, 626 N. Pine Ave., Chicago, Ill. Meeting second Monday in month, except June, July and August, Great Northern Hotel, Chicago, Ill.

CAR FOREMEN'S ASSOCIATION OF ST. LOUIS.—R. E. Giger, 721 North 23rd street, E. St. Louis, Ill. Meetings, first Tuesday in month at the American Hotel Annex, St. Louis.

CENTRAL RAILWAY CLUB.—H. D. Vought, 26 Cortlandt St., New York, N. Y. Regular meetings second Thursday January to November. Interim meetings second Thursday, February, April, June, Hotel Statler, Buffalo, N. Y. Next meeting April 10. Papers on Handling L. C. L. Freight and Joint Inspection of the Trunk Line Freight Inspection Bureau of Buffalo, will be read by George A. Bax, local freight agent, and John C. Smith, district manager, New York Central, respectively.

CHIEF INTERCHANGE CAR INSPECTORS' AND CAR FOREMEN'S ASSOCIATION.—A. S. Sternberg, Belt Railway, Clearing Station, Chicago. Annual meeting Hotel Sherman, Chicago, September 16, 17 and 18.

CINCINNATI RAILWAY CLUB.—W. C. Cooder, Union Central Building, Cincinnati, Ohio. Meetings second Tuesday, February, May, September and November.

CLEVELAND STEAM RAILWAY CLUB.—F. L. Ferricks, 14416 Adler Ave., Cleveland, Ohio. Meeting first Monday each month at Hotel Cleveland. Public Square, Cleveland.

INTERNATIONAL RAILROAD MASTER BLACKSMITHS' ASSOCIATION.—W. J. Mayer, Michigan Central, 2347 Clark Ave., Detroit, Mich. Next meeting Hotel Sherman, Chicago, August 19, 20, 21.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—J. B. Hutchinson, 6000 Michigan Ave., Chicago, Ill. Next meeting Hotel Sherman, Chicago, May 26, 27, 28.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—William Hall, 1061 W. Wabash St., Winona, Minn. Annual convention September 9 to 12. Hotel Sherman, Chicago.

MASTER BOILERMAKERS' ASSOCIATION.—Harry D. Vought, 26 Cortlandt St., New York, N. Y. Next convention May 20-23. Hotel Sherman, Chicago.

NEW ENGLAND RAILROAD CLUB.—W. E. Cade, Jr., 683 Atlantic Ave., Boston, Mass. Regular meetings second Tuesday in month, except June, July, August and September, Copley-Plaza Hotel, Boston, Mass. Next meeting April 8. A paper on The Passenger Car Up-To-Date will be read by C. E. Barba, superintendent, Osgood Bradley Car Company. Annual banquet and entertainment May 13-24.

NEW YORK RAILROAD CLUB.—H. D. Vought, 26 Cortlandt St., New York. Meeting third Friday of each month except June, July and August at 29 West Thirty-ninth St., New York.

NIAGARA FRONTIER CAR MEN'S ASSOCIATION.—George A. J. Hochgreb, 623 Brisbane Building, Buffalo, N. Y.

PACIFIC RAILWAY CLUB.—W. S. Wollner, 64 Pine St., San Francisco, Cal. Regular meetings second Thursday in month, alternately in San Francisco and Oakland, Cal.

RAILWAY CLUB OF GREENVILLE.—G. Charles Hoey, 27 Plum St., Greenville, Pa. Meetings last Friday of each month, except June, July and August.

RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, 515 Grandview Ave., Pittsburgh, Pa. Regular meeting fourth Tuesday in month, except June, July and August, Fort Pitt Hotel, Pittsburgh.

ST. LOUIS RAILWAY CLUB.—B. W. Frauenthal, Union Station, St. Louis, Mo. Regular meetings second Friday in month, except June, July and August. Next meeting April 11. Illustrated lecture on The Steel Industry, by R. J. Kaylor, publicity manager, Youngstown Steel & Tube Company.

SOUTHEASTERN CARMEN'S INTERCHANGE ASSOCIATION.—J. E. Rubley, Southern railway shops, Atlanta, Ga.

TRAVELING ENGINEERS' ASSOCIATION.—W. O. Thompson, 1177 East Ninety-eighth St., Cleveland, Ohio. Annual meeting Hotel Sherman, Chicago, September, 1924.

WESTERN RAILWAY CLUB.—Bruce V. Crandall, 605 North Michigan Ave., Chicago. Meetings third Monday in each month, except June, July and August. Next meeting April 21. A paper on Serviceability Economics of 100 Per Cent Locomotives, will be read by C. A. Seley.

SUPPLY TRADE NOTES

Benjamin M. Carr, sales agent of the Pullman Company, died on March 22 at Houston, Texas.

Frederic E. Wright has joined the sales department of the International Oxygen Company, Newark, N. J.

The Chicago Pneumatic Tool Company will construct a three-story, 45 ft. by 126 ft. extension to its plant at Cleveland, Ohio.

Leroy Beardsley, treasurer of the Chicago Pneumatic Tool Company from 1898 to 1918, died on March 5, at Riverside, Ill.

The Pittsburgh, Pa., office of the Niles-Bement-Pond Company has been removed from 425 Seventh avenue to 503 Liberty avenue.

John W. Shoop, office manager of the Lehon Company, Chicago, has been promoted to manager of railway sales, with headquarters at Chicago.

J. L. Phillips, manager of the Atlantic office of the Okonite Company, has been transferred to San Francisco as manager of the San Francisco office.

E. D. Allmendinger, manager of the foreign department of the Black & Decker Manufacturing Company, Towson, Md., sailed for England recently in the interest of his company.

Arthur P. Skaer, assistant chief engineer of the Corrugated Bar Company, has been appointed district manager of the Kalman Steel Company, with headquarters at Buffalo, N. Y.

Herbert Mertz, secretary and sales manager of the Orton-Steinbrenner Company, with headquarters at Chicago, has been elected a director, succeeding H. G. Steinbrenner, resigned.

L. Sparks, New England manager of the Erie Steam Shovel Company, has been appointed eastern sales manager of the Ohio Locomotive Crane Company, with headquarters at New York.

Howard W. Evans, vice-president and general manager of George B. Limbert & Co., Chicago, has been appointed executive vice-president and sales manager of Warren Corning & Co., Chicago.

F. E. Finley, formerly manager railway sales, Laclede Steel Company, has become associated with the Kansas City Bolt & Nut Company, as district sales agent, with headquarters at St. Louis, Mo.

The Pawling & Harnischfeger Company, Milwaukee, has purchased from the receivers the entire property of the Hercules Steel Castings Company, Milwaukee, and will operate the plant about May 1.

C. E. Eklind, chief draftsman in the office of the engineer of car construction of the Atchison, Topeka & Santa Fe, has been appointed mechanical engineer of the Camel Company, with headquarters at Chicago.

The Clark Car Company, Pittsburgh, Pa., has removed its New York City office from the Woolworth building to 52 Vanderbilt avenue, suite 803. B. K. Mould, eastern manager, is in charge of this office.

The Bulldog Automatic Coupler Company, Pikesville, Ky., has been incorporated with the following officers: A. J. Baldwin, president; Charles D. Jacobs, vice-president, and A. L. Nunnery, secretary and treasurer.

C. J. Priebe has recently joined the sales organization of the Keller Mechanical Engineering Corporation, Brooklyn, N. Y. Mr. Priebe was previously engaged in editorial and advertising work for the American Machinist.

The Baldwin Locomotive Works has begun the gradual removal of its entire Philadelphia shops to Eddystone, Pa. The estimated cost of this work, which is being done under the direction of Samuel M. Vauclain, is $16,000,000.

The Landis Machine Company, Waynesboro, Pa., has adopted the name "Land-Matic" for its line of automatic die heads for turret lathes and hand-operated screw machines. In the future, this product will be known as the Land-Matic die heads.

The Morton Manufacturing Company, Chicago, has appointed the Consolidated Equipment Company as its representative for the sale of Acme Line of Railway Appliances for the Dominion of Canada with headquarters at 260 St. James street, Montreal, Que.

The Cleveland office of the Simmons-Boardman Publishing Company, publishers of the *Railway Mechanical Engineer* and other railroad and marine papers, has been moved from 4300 Euclid avenue to more commodious quarters at 6007 Euclid avenue.

The Ward Railway Equipment Company, Lima, Ohio, has been incorporated for $50,000, to manufacture miscellaneous equipment for railroads. The incorporators are O. G. Snyder, Edward P. Kirly, George T. Shanbow, B. E. Parish, J. T. Ward, Charles Ershick and J. B. Rowntree.

The American Railway Car Company, Portland, Ore., is preparing to erect a factory at Tigard, Ore., for the manufacture of Bowen gasoline railway cars. Officers of the company are A. B. Bowen, president; A. C. Forrester, vice-president, and Macdonald Potts, secretary-treasurer.

John M. Mack, inventor of the Mack truck and founder of the Mack Motorcar Company, which later became the International Motor Company, was killed March 14 near Neffs, Pa., when a work car of the Lehigh Valley Transit Company crashed into the automobile he was driving.

The Dixon Waste Company, with office and works at Manayunk, Philadelphia, Pa., will in future assume deliveries of all regular products of the Trumbull Waste Manufacturing Company of Manayunk. The latter company on March 5 discontinued active business and is now liquidating its affairs.

The Galion Iron Works & Mfg. Company, Galion, Ohio, is organizing a railroad sales department. The St. Louis office, handling the central and western territory, has been placed in charge of Taylor D. Kelley and Harvey DeCamp. The company will specialize on 25, 50 and 100-ton coal tipples and railroad cinder hoists.

Joseph W. Irwin has resigned as superintendent of the Fort Pitt Spring & Manufacturing Company, Pittsburgh, Pa., to take the position of vice-president and general superintendent of the Mitchell Spring & Manufacturing Company, Inc., Johnstown, Pa. Mr. Irwin has had a long operating experience in the manufacture of railroad, electric traction and industrial springs, having been with the Fort Pitt Spring & Manufacturing Company for the past 12 years. He formerly served for a period of 25 years with the A. French Springs Works, which later became the Railway Steel Spring Company, having begun his service with that company as one of the shopmen and working up to the position of assistant superintendent.

J. W. Irwin

The Heim Grinder Company, Danbury, Conn., was organized on March 1, having acquired the entire interest of The Ball & Roller Bearing Company in the Heim centerless grinder. The following were elected officers of the company: Henry N. Flynt, president; Clayton O. Smith, vice-president, and Ferris M. Angevin, secretary and treasurer.

The Graver Corporation has moved its railroad office from 1412 Steger building, Chicago, to the main office and works of the company at East Chicago, Ind., and will retain its office in Chicago as a branch sales office. J. J. Felsecker, manager of water softening sales, will have charge of the railroad department, succeeding W. R. Toppan, resigned.

C. H. Pridey, salesman of S. F. Bowser & Co., with headquarters at St. Louis, Mo., has been promoted to superintendent of the Kansas City district with headquarters at Kansas City. D. S. Price, an engineer, has been promoted to district manager in charge of the lubrication and filtration department, with headquarters at Detroit, Mich. O. M. Tottom, engineer, has been promoted to district manager in charge of the lubrication and filtration department, with headquarters at Indianapolis, Ind.

The Tennant Company, Union National Bank Building, Houston, Texas, now represents the Heine Boiler Company, St. Louis, Mo., in a new territorial division comprising the entire southern half of the state of Texas. J. A. Tennant is in charge of this office. Smith & Whitney, Dallas, Texas, will continue as representative of the Heine Boiler Company in the northern half of Texas.

Fred A. Meckert has resigned as general manager of the Fort Pitt Spring & Manufacturing Company, Pittsburgh, Pa., to become president and general manager of the Mitchell Spring & Manufacturing Company, Inc., of Johnstown, Pa. This company was incorporated recently with a capital stock of $350,000. Mr. Meckert has been with the Fort Pitt Spring & Manufacturing Company since March 1, 1919, having gone to that company from the Standard Steel Works Company, Philadelphia, Pa., where he served for 14 years and in charge of the spring department as manager and spring designer. Before entering the service of the Standard Steel Works Company, Mr. Meckert was employed for three years as private secretary of Albert Ladd Colby, who at that time was assistant to president of the International Nickel Company, in New York City.

F. A. Meckert

J. J. Edwards, vice-president of the O. M. Edwards Company, Syracuse, N. Y., has established his headquarters at the Chicago office of the company, First National Bank Building, where in conjunction with C. H. Rockwell, western manager, he will give special attention to the varied interests of that company. Mr. Edwards expects to be located in Chicago for about two years.

Stuart J. Dewey, formerly assistant signal engineer of the Cleveland, Cincinnati, Chicago & St. Louis, with headquarters at Cincinnati, Ohio, and more recently engineer with the State Highway Commission of Pennsylvania, has been appointed sales engineer of the Truscon Steel Company, with headquarters at New York. The Truscon Steel Company has leased a building at Erie and St. Clair streets, Chicago, to which it will move its Chicago offices on May 1.

H. S. Brautigam, assistant to the master car builder of the Chicago, Milwaukee & St. Paul, has resigned to become a representative of the railroad department of the Allegheny Steel Company, Brackenridge, Pa. Mr. Brautigam has served for about thirteen years in the car department of the Chicago, Milwaukee & St. Paul in various capacities, consecutively as clerk, car inspector, chief clerk, assistant car foreman, general safety appliance inspector and assistant to the master car builder.

Elijah Bates, local manager of Haskins & Sells, public accountants, with headquarters at Cleveland, Ohio, has been appointed secretary and treasurer of the McMyler-Interstate Company, with headquarters at Cleveland, Ohio, succeeding H. H. Hammond, resigned. The Chicago office of the McMyler-Interstate Company has been moved to 648 Railway Exchange building, and a new branch office has been opened at 619 Genesee building, Buffalo, N. Y., in charge of J. E. McFate, Buffalo district representative.

The Davis Boring Tool Company, St. Louis, Mo., is erecting a fireproof factory building 182 feet long and 75 feet front, that will cost approximately $130,000. It is of modern construction throughout and is to be one of four similar units to be constructed

on land owned by the company. This building will be approximately two and one-half times larger than the present factory and, with the new equipment that the company expects to install, it is calculated that the production of the plant will be increased about five times.

N. B. Norris, district manager at New Orleans, La., of the Pawling & Harnischfeger Company, Milwaukee, Wis., has been appointed district manager of the Memphis, Tenn., office. D. J. Murphy of the New Orleans office has been appointed district manager of the Texas district, with headquarters at Dallas, Texas. F. W. Truex will continue as district manager at Atlanta, Ga., with office at 212 Haas-Howell building and W. J. Dugan as southern sales manager will assume charge of the entire southern territory, with headquarters at Memphis.

Frederick V. Green was elected second vice-president of the Pittsburgh Testing Laboratory, Pittsburgh, Pa., at the February meeting of the board of directors. His headquarters will be at the New York office of the company, 50 Church street and he will have direct charge of the eastern district. Mr. Green was born in New York City and received his education at Nyack, N. Y. After serving in the lumber business he organized in 1895 the Empire Engine & Motor Company, and was its treasurer until 1902, when he became associated with the Westinghouse Air Brake Company as assistant general sales manager in the New York territory. From 1919 he served for about four years as sales manager of the Baldwin Locomotive Works, at Johannesburg, South Africa. Since September, 1923, he has been with the Pittsburgh Testing Laboratory as assistant to the president.

F. V. Green

The Colorado Central Railways Company, Denver, Colo., has been incorporated under the laws of Colorado for the purpose of manufacturing steam and electric railway cars and other railway equipment. It will operate in conjunction with the American Railway Steel Corporation and the Missouri Car Company, East St. Louis, Ill. The company has taken over the plant formerly used by the Denver Paper Company. Orrin Merry, president of the Missouri Car Company, is president of the Colorado Central Railways Company and M. L. Phelps is consulting engineer.

Charles N. Winter, managing editor of the Locomotive Cyclopedia and the Car Builders' Cyclopedia and formerly associate editor of the *Railway Mechanical Engineer*, has resigned to become general manager of the Rogatchoff Company of Baltimore, Md. Mr. Winter's headquarters will be at 90 West Broadway, New York, and in the Koehler building, Ridgewood, N. J. His new duties will include the direction of sales and advertising of the Rogatchoff Company in the United States, Canada, Great Britain and Australia.

R. C. Shaal, president of the R. C. S. Equipment Company, New York City, formerly vice-president of the Safety Car Heating & Lighting Company in charge of electrical department, New York, and long associated with the sales department of the Pyle National Company as vice-president in charge of sales and maintenance for territory east of Chicago, and other railway supply companies, is now associated with the Standard Stoker Company, Inc., at New York, in special sales work. Mr. Shaal will continue as president of the R. C. Shaal Company and retain the relations which he holds in other companies.

H. D. Megary, managing director of the Consolidated Pneumatic Tool Company, London, England, died on March 20. Mr. Megary was born in Philadelphia on April 21, 1888, and graduated from the University of Pennsylvania in 1909. Following his graduation he became affiliated with the Bethlehem Steel Company, remaining with that company until June, 1918, when he went to the Chicago Pneumatic Tool Company as assistant to the president, later being made secretary of the company. In 1921 he was transferred to London to assume the duties of managing director of the English company. He was also director of European sales.

William R. Hillary has been appointed sales engineer with headquarters at the home office of the National Lock Washer Company, Newark, N. J. Mr. Hillary is an engineer of wide railroad experience, having started his career with the Pennsylvania Railroad System, as assistant on the engineering corps in the Cincinnati division, immediately upon his graduation from the University of Pennsylvania, in 1897, where he received the degree of civil engineer. He subsequently held many important positions, having served consecutively as assistant supervisor, assistant division engineer, division engineer and engineer of maintenance of way, at Toledo, Ohio.

George Frank Konald, general manager and treasurer of the Warren Tool and Forge Company, Warren, Ohio, died in a hospital in that city on March 3, from complications following an operation. He was born at East Douglas, Mass., on June 25, 1864, and at the age of 15 entered the employ of the Iron City Tool Works as a hammerman's helper, later becoming a hammerman. He was employed in various positions in this plant for the following nine years, when, at the age of 24, he succeeded his father as superintendent of this plant. He held this position until December, 1911, when he became associated with the Warren Tool & Forge Company, which had been organized by his brother, M. J. Konald and J. D. Robertson, and continued his connection with that company until his death.

H. C. Oviatt, formerly general mechanical superintendent of the New York, New Haven & Hartford, is now associated with the Standard Stoker Company, Inc., as assistant to the president, with headquarters in the Grand Central Terminal, New York City. Mr Oviatt has had many years' railroad experience in both mechanical and transportation departments, having entered the service of the New York, New Haven & Hartford in 1889 as locomotive fireman. He later was promoted to locomotive engineman and subsequently served successively as air brake inspector, master mechanic and assistant mechanical superintendent. He then entered the transportation department as division superintendent and later was promoted to general superintendent. During the war he went with the American International Shipbuilding Corporation at Hog Island and organized and operated the transportation department in connection with the building of ships for the government. He returned to the New York, New Haven & Hartford in 1918 as superintendent of the Central New England and in a few months was made superintendent of motive power of the New Haven, and later general mechanical superintendent. At the time he left railroad work, Mr. Oviatt was a member of the General Committee, the Committee on Locomotive Design and Construction, Div. V, Mechanical, of the A. R. A.

H. C. Oviatt

The Wayne Tank & Pump Company, Ft. Wayne, Ind., has established an organization among the sales representatives of its water softening division, to be known as the Wayne H-2-O Club. Salesmen who have reached their sales quota are eligible for membership. The purpose of the club is to foster better salesmanship in the marketing of the company's products, to create a feeling of friendly rivalry between salesmen and the various district offices and to promote better understanding and co-operation between the field and office forces of the water softening division. Officers of the club will be selected on the basis of the volume of business during the year. The ten members of the board of directors will be those having the next highest volume of business handled. Each representative qualifying

for membership in the club will be presented with a gold emblem and a diamond will be mounted on the emblem for each successive year. Special awards will also be given annually for high volumes of business.

Fred A. Hansen was appointed district manager for the Electric Heating Apparatus Company in the Chicago territory, effective with the recent termination of a sales agreement of this company with the Westinghouse Electric & Manufacturing Company. Mr. Hansen attended Northwestern University, Chicago, and the University of North Dakota and first entered railway service in 1913 on the Atchison, Topeka & Santa Fe in the track department. In 1914 he left the Santa Fe to enter the signal department of the Chicago, Rock Island & Pacific and later served the American Bell Telephone Company until he entered the army during the late war. Mr. Hansen served about a year in France in the engineering corps of the army, and after the armistice he had charge of the electrical construction work at the Savenay Base Hospital center in France. Upon his return to the United States he entered the employ of the Westinghouse Electric & Manufacturing Company as industrial heating engineer, handling electric furnaces and other industrial electrical heating matters. On September 1, 1923, the sales agreement between the Electric Heating Apparatus Company, Newark, N. J., and the Westinghouse Electric & Manufacturing Company was terminated, and Mr. Hansen was appointed district manager, with headquarters in Chicago.

Charles W. T. Stuart has resigned as foreman of car lighting of the Pennsylvania Railroad to become representative in the Philadelphia office of the Safety Car Heating & Lighting Company. Mr. Stuart was born in Philadelphia in 1888 and, after studying at the Engineering School of the Drexel Institute, entered the car lighting department of the Pennsylvania Railroad in 1909. At that time there were but a few electric lighted cars. Mr. Stuart has made a specialty of this particular branch of railway equipment ever since he became connected with the railroad. He has contributed largely to railway publications on car lighting subjects, including a series of articles in the Railway Electrical Engineer on the fundamental principles of car lighting. His largest contribution to car lighting literature is his recent book "Car Lighting by Electricity," which is the first complete volume covering this subject.

C. W. T. Stuart

Tom G. Windes, manager of the railroad department of the International Filter Company, Chicago, has resigned to become general sales manager of the recently organized Aluminate Sales Corporation, Union Stock Yards, Chicago, distributors of aluminate of sodium now being manufactured on a commercial scale for use in water softening. He was born on April 26, 1879, in Chicago and studied chemical engineering at the University of Wisconsin, graduating in 1902. He then entered the employ of the Pfister & Vogel Leather Company, Milwaukee, as a chemist, which position he held until the following year, when he entered the metallurgical laboratories of the Illinois Steel Company, Chicago. Later he was employed as a chemist in the Griffin Car Wheel Works until 1905 when he became associated with the Kennicott Water Softening Company, Chicago. He entered railway service the following year as a chemist in charge of water softening on the Vandalia (now the St. Louis division of the Pennsylvania), where he remained until 1909, when he returned to the reorganized Kennicott Company as manager of the railroad department. In 1916 he became Chicago representative of the L. M. Booth Company, New York, and after the absorption of this company by the Refinite Company, Omaha, Neb., in 1920, continued in the same capacity with the latter organization until July, 1921, when he re-entered the employ of the International Filter Company, Chicago, as manager of the railroad department.

T. F. Manville, president and treasurer of Johns-Manville, Inc., New York, was elected chairman of both the board and the executive committee at a recent meeting of the board of directors; H. E. Manville, vice-president and secretary, has been elected president; L. R. Hoff, general sales manager at New York, has been elected vice-president and general manager of the company; W. R. Seigle has been re-elected vice-president and general manager of the factories and mines; J. E. Meek, general manager of the railroad and United States Government department, and J. W. Perry, general manager of the electrical department; also J. S. Carroll, general manager of the oil industry department have been elected vice-presidents; A. C. Hoyt, assistant treasurer, has been elected secretary and treasurer, and T. F. Manville, Jr., has been appointed assistant secretary, all with headquarters at New York. The members of the newly elected executive committee are T. F. Manville, H. E. Manville, L. R. Hoff and W. R. Seigle. Mr. Meek was born at State College, Pa. He served seven years with the Pennsylvania Railroad at Altoona, Pa., shops, later going to Denver, Colo., in 1888, remaining there for six years, the last three years of which he was chief engineer of power plant. He entered the employ of the H. W. Johns Company, New York City, in 1894, and went with the new organization of the H. W. Johns-Manville Company in 1902, and formed the railroad and United States government departments of this company in 1906, and has held the position of general manager of same up until his present promotion. He still retains direct supervision of these departments in addition to other duties. He is also a director of the corporation.

Pratt & Lambert, Inc., Elects New Officers

At a recent meeting of the board of directors of Pratt & Lambert, Inc., Buffalo, N. Y., A. D. Graves was elected senior vice-president and treasurer; J. B. Bouck, Jr., was elected vice-president in charge of the eastern division at New York City and F. W. Robinson was elected vice-president in charge of manufacturing. The following officers were re-elected: J. H. McNulty, president; J. N. Welter, vice-president in charge of the western division; H. E. Webster, secretary. A. D. Graves entered the service of Pratt & Lambert, Inc., in 1908 as a salesman; ten years later he became manager of trade sales. In January, 1921, he was promoted to general manager and now becomes senior vice-president and treasurer. J. B. Bouck, Jr., began service with Pratt & Lambert, Inc., in 1893 as office boy. He subsequently served successively as salesman, assistant resident manager and resident manager. In 1917 he was appointed secretary-treasurer of the company and has now been elected vice-president in charge of the eastern division, with headquarters at New York City. F. W. Robinson began work with Pratt & Lambert, Inc., at its New York plant in 1896, he subsequently served as general superintendent and now becomes vice-president in charge of manufacturing.

Let Good Humor Be a Habit, Nobody Ever Heard of a Grouch Getting Anything But the Gate

TRADE PUBLICATIONS

BELTING.—"Quality Facts About Belting" is the title of a series of helpful suggestions on belt buying, which is being issued by the Chas. A. Schieren Company, New York.

WIRES AND CABLES.—Both railroad and power installations of Okonite wires and cables are shown in an illustrated booklet recently issued by the Okonite Company, Passaic, N. J.

INDUSTRIAL FURNACES.—Stewart furnaces, capable of handling any class of work in heat treating, are described in an illustrated folder recently issued by the Chicago Flexible Shaft Company, Chicago.

GRINDING MACHINES.—A general description of the Gisholt internal and link grinder for railroad work, also a description of the link grinding attachment, is contained in a four-page folder issued by the Gisholt Machine Company, Madison, Wis.

FLEXIBLE METAL HOSE.—The American Metal Hose Company, Waterbury, Conn., has issued a 24-page brochure descriptive of its flexible metal hose, which is especially adapted for conveying steam and oils and for numerous other special purposes.

STANDARDIZATION.—The American Engineering Standards Committee, New York, has just issued an interesting booklet entitled, "Standardization—what it is doing for industry." This describes how standardization is being carried on; first, in the individual plant; second, in industry as a whole; third, nationally on an inter-industrial basis, and, fourth, internationally.

POWER PIPE MACHINE.—The "Willie Williams," a new portable pipe threading, cutting-off and reaming machine, is fully described and illustrated in a catalogue recently prepared by the Williams Tool Corporation, Erie, Pa. The machine is demountable, has a wide threading, cutting-off and reaming capacity, and has a handy self-contained grinder and three drives—motor, belt and hand.

SAWS AND TOOLS.—Catalogue E, illustrating and describing a complete line of solid and inserted tooth metal cutting circular saw blades, inserted tooth setting device, serrating device for friction disks, slate saws, pipe cutters, circular knives, rotary shear blades, saw sharpening machines, pneumatic hammer rivet sets and chisel blanks and hardened steel specialties, has recently been issued by the Hunter Saw & Machine Company, Pittsburgh, Pa.

TWIN-SPAN TURNTABLE.—Catalogue TS, containing a complete description and specifications for Bethlehem twin-span turntables, also a number of full page illustrations showing typical installations, has recently been issued by the Bethlehem Steel Company, Bethlehem, Pa. The twin-span turntable is of a non-balanced type. This feature eliminates the necessity of balancing the table when turning an engine, thus giving it a greater capacity than the balanced type table of equal length.

SPECIFICATIONS FOR LUBRICANTS.—Technical Paper 323-A, "United States Government specification for lubricants and liquid fuels and methods for testing," has just been issued by the Department of the Interior, through the Bureau of Mines, Washington, D. C. This specification, known as standard specification No. 2c, is a revision of the specification officially adopted by the Federal Specifications Board on February 3, 1922, for the use of the departments and independent establishments of the government in the purchase of materials covered by it. It becomes mandatory June 18, 1924.

SCREW CUTTING TOOLS AND MACHINES.—An attractive 204-page illustrated catalogue of screw cutting tools and machines has recently been issued by the Geometric Tool Company, New Haven, Conn. The catalogue is divided into six parts. Part I outlines the specialized and standardized Geometric screw cutting tools, the field and range of utility and adaptability, etc. The basic principles and the different styles of self-opening and adjustable die heads are described in Part II. Instructions for operating and ordering are also given in this section. Part III is devoted to adjustable and collapsing taps. Parts IV and V cover chaser grinders and threading machines. "Standard Threads" is the title of Part VI, in which interesting comparisons of diameters and pitches of A. S. M. E., S. A. E., Metric standard, International and French standard, British standard threads, etc., are given.

PERSONAL MENTION

General

W. H. FETNER, assistant to the president of the Missouri Pacific, with headquarters at St. Louis, Mo., has been promoted to chief mechanical officer, with the same headquarters, a newly created position.

Master Mechanics and Road Foremen

G. H. LANGTON, formerly mechanical inspector of the Chesapeake & Ohio, has been appointed general master mechanic of the Eastern General division, with headquarters at Clifton Forge, Va.

H. K. LESURE, chief electrician in the office of the general superintendent of motive power of the Eastern Region of the Pennsylvania, has been appointed master mechanic of the New York Terminal.

W. A. BEDELL, general master mechanic of the Missouri Pacific at St. Louis, Mo., has been assigned to the Lines West and St. Louis Terminal division west of the Mississippi river, excepting the Sedalia back shop.

W. R. KENNEDY, assistant master mechanic in charge of the rebuilding of locomotives at the Montreal Locomotive Works, has been appointed to fill the newly created position of assistant master mechanic of the Wabash, with headquarters at Peru, Ind.

Ross H. HALE, whose appointment as master mechanic of the Alaska Railroad at Anchorage, Alaska, was announced in the March issue of the *Railway Mechanical Engineer*, was born on April 28, 1896, at Eau Claire, Wis. He received a grammar and technical school education, and from 1913 to 1917 was in the employ of the Southern Pacific as a machinist apprentice and machinist. In 1918 he became marine machinist and insulation foreman of the Patterson McDonald Shipyards at Seattle, Wash. He then successively served as a machinist on the Los Angeles & Salt Lake at Los Angeles, Cal.; mechanical inspector at Salt Lake City, Utah; erecting foreman at Provo, Utah; roundhouse foreman at Lynndyl, Utah; district foreman at Caliente, Nev.; roundhouse foreman at Los Angeles, and general foreman at Kelso, Cal.

R. H. Hale

D. W. CUNNINGHAM, general master mechanic of the Missouri Pacific, with headquarters at Little Rock, Ark., has been assigned to the Lines South, St. Louis Terminal east of the Mississippi river, Illinois division and North Little Rock and Sedalia back shops.

M. J. DUNNEBACKE has been appointed master mechanic of the Duluth, South Shore & Atlantic, succeeding J. Herron, superintendent of motive power and machinery, who has resigned. The office of superintendent of motive power and machinery has been abolished.

Car Department

H. A. SIGWART, traveling mechanical inspector of the Illinois Central, with headquarters at Memphis, Tenn., has been appointed supervisor of car repairs for the Missouri Pacific, with headquarters at St. Louis, Mo.

Shop and Enginehouse

ALBERT L. HAFNER has been promoted to assistant shop foreman of the Mt. Clare shops of the Baltimore & Ohio at Baltimore, Md.

A. W. FISHER has been appointed superintendent of shops of the Baltimore & Ohio at Sandusky, Ohio, succeeding F. J. Cheshire.

ARLEY HAY, machinist, has been appointed assistant roundhouse foreman of the Kansas City Southern, with headquarters at Pittsburg, Kans.

F. J. CHESHIRE, superintendent of shops of the Baltimore & Ohio, with headquarters at Sandusky, Ohio, has been transferred to South Chicago, Ill.

T. L. MALLAM, foreman of the Trenton boiler shop of the Pennsylvania, has been appointed foreman of the Juniata boiler shop at Altoona, Pa., succeeding T. J. McKerihan.

A. F. STIGLMEIER has resigned as general boiler foreman of the Mt. Clare shops of the Baltimore & Ohio to accept a like position with the New York Central at West Albany, N. Y.

J. W. LEMON, master mechanic on the Missouri Pacific, with headquarters at Hoisington, Kans., has been promoted to superintendent of shops at Sedalia, Mo., succeeding J. P. Brown.

B. H. WERDEL, formerly machine shop erecting foreman of the Chicago Great Western at Oelwein, Ia., has been appointed general roundhouse foreman, with the same headquarters, succeeding George Hain.

GEORGE HAIN, formerly general roundhouse foreman of the Chicago Great Western at Oelwein, Ia., has been appointed acting shop superintendent, with the same headquarters, succeeding A. B. Clark, deceased.

E. R. LARSON, general foreman, motive power department of the Delaware, Lackawanna & Western, with headquarters at Kingsland, N. J., has been appointed shop superintendent of the Bellmead shops of the Missouri-Kansas-Texas, with headquarters at Waco, Tex.

H. M. WARDEN has been promoted to superintendent of the locomotive department of the Missouri-Kansas-Texas, with headquarters at Parsons, Kans. Mr. Warden was born on January 12, 1887, at San Antonio, Tex. He entered railway service as a machinist apprentice on the San Antonio & Aransas Pass and in August, 1914, was appointed machinist on the Missouri-Kansas-Texas. He was promoted to roundhouse foreman in December, 1914, and in May, 1915, he was promoted to general foreman at Wichita Falls, Tex. Mr. Warden was transferred to Smithville, Tex., in August, 1916, and was promoted to superintendent of the reclamation plant at Parsons, Kans., in October, 1918. He held this position until December, 1923, when he was promoted to shop superintendent at Waco, Tex. Mr. Walden held this position until his promotion to superintendent of the locomotive department, with headquarters at Parsons, Kans.

H. M. Warden

Purchasing and Stores

JOHN G. HILGEN, storekeeper of the Chesapeake & Ohio at Newport News, Va., has been transferred in the same capacity to Russell, Ky.

C. W. ERB has been appointed assistant storekeeper of the Pennsylvania, with headquarters at Trenton, N. J., succeeding D. B. Cooper, retired.

F. H. POTTER has been appointed division storekeeper of the Pere Marquette, with headquarters at Saginaw, Mich., succeeding B. J. Abbott, resigned.

J. L. HARBRY has been appointed division storekeeper of the Pere Marquette, with headquarters at Grand Rapids, Mich., succeeding H. J. Van Ness, resigned.

F. W. MEIER has been appointed local storekeeper of the Duane shops of the Cleveland, Cincinnati, Chicago & St. Louis at Terre Haute, Ind., succeeding H. C. McCoy, resigned.

F. S. MCCLUNG, whose promotion to purchasing agent of the Texas & Pacific, with headquarters at Dallas, Tex., was reported in the March *Railway Mechanical Engineer*, entered railway service in October, 1908, as a storekeeper on the Illinois Central at Louisville, Ky. He entered the service of the Texas & Pacific in 1910 in the stores department, and in 1921 was promoted to general storekeeper. Mr. McClung held this position until his recent promotion to purchasing agent.

Obituary

A. B. CLARK, shop superintendent of the Chicago Great Western at Oelwein, Ia., died suddenly on February 11.

HARRY WANAMAKER, district superintendent of motive power of the New York Central, with headquarters at Albany, N. Y., died on March 23 at Elkhart, Ind., from pneumonia while on an official trip for the company. Mr. Wanamaker was born on August 5, 1866, at Pottsville, Pa. He received a high school education and began railroad work on August 1, 1884, with the Philadelphia & Reading, as a machinist apprentice. He was promoted to machinist in 1888 and served in that capacity until 1896, when he was appointed gang foreman at Reading, Pa. He left the Philadelphia & Reading in March, 1900, to become a foreman in the erecting shops of the New York Central at West Albany, N. Y., where he remained until 1905, when he was transferred to Depew, N. Y., as general foreman. On January 1, 1912, he was appointed superintendent of shops, with the same headquarters, and was transferred to West Albany on May 20, 1912. On July 1, 1920, he was promoted to district superintendent of motive power at Albany, and on September 1, 1922, he was appointed assistant superintendent of motive power. On December 10, 1923, Mr. Wanamaker was appointed district superintendent of motive power, with the same headquarters, the position he was holding at the time of his death.

H. Wanamaker

THE GERMAN GENERAL ELECTRIC COMPANY has delivered to a Dutch concern the first of three internal combustion motor-driven cars for use on the Kampen Zwolle, Province of Overijsel (Holland) railway line. The motors were constructed by a Berlin company and the car and other equipment were turned out at Cologne. The car came from Cologne under its own power. The car is supported by two two-axle trucks, one axle of each of which is operated by a 75-hp., 6-cylinder gasoline motor at either end of the car. Transmission, reverse and throttle are operated by compressed air. Controls are situated on both end platforms and the motors may be regulated individually or jointly. The control mechanism includes a "dead man's handle" that provides an automatic stop device. The car is intended for one-man operation, has Westinghouse brakes and Bosch dynamo lighting, and is heated by the radiator water. The body is entirely of steel. Fuel consumption is reckoned at six-tenths of a liter of gasoline per kilometer, costing about six cents. The maximum speed is 75 kilometers an hour. The car contains 25 second-class and 40 third-class seats, with 20 places for standees.